Minimate Pro™

Operator Manual

Instantel

The World's Most Trusted Vibration Monitors

720U2301

Instantel®

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Customer Support:

Instantel is represented by a network of qualified dealers throughout the United States, Canada, and Internationally. For further information, including product literature and the location of the dealer nearest you, contact **Instantel**.

- Extensive dealer network.
- Comprehensive application support.
- In–depth user documentation.
- Technical support, 1–613–592–4642 or e-mail service@instantel.com

Warranty:

All **Instantel** products come with a one-year warranty. **Series IV** monitors, **Minimate Pro4** and **Minimate Pro6**, and sensors will have the warranty extended for a second year if they are returned to the **Instantel** factory for service and calibration within 30 days of the 'Next Calibration' date printed on the calibration label located on the product.

If within a period of one year from the date of shipment to a customer the instrument fails to perform in accordance with **Instantel's** published specifications and the operator's manual, due to a defect in materials or workmanship, it will be repaired or replaced at **Instantel's** option, free of charge. This warranty is void if the equipment has been dismantled, altered or abused in any way. This warranty is nontransferable.

The above warranty does not include any implied warranty of functionality for a particular purpose. **Instantel** assumes no responsibility for damages of any description resulting from the operation or use of its products. Since it is impossible to anticipate all of the conditions under which its products will be used either by themselves or in conjunction with other products, **Instantel** cannot accept responsibility for the results unless it has entered into a contract for services which clearly define such an extension of responsibility and liability.

Any shipments returned directly to **Instantel** Inc. must have our prior approval and all packages must display the Return of Material Authorization (RMA) Number issued by **Instantel**. Shipping charges to **Instantel's** plant will be paid by the customer and those for return to the customer will be paid by **Instantel**.

To protect your warranty, you must complete and return a Warranty Registration Certificate, or complete the online Warranty Registration Form, within ten days of purchase. Units will be assumed out of warranty if there is no warranty card on file at **Instantel**. Retain this portion and the proof of purchase for your records.

Warning:

This is an electronic instrument. Although it has been designed for field use, it contains sensitive components which cannot be expected to withstand the same stress and shock as heavy machinery. It contains a microcomputer and solid state memory, both of which may be made inoperative by severe radio interference. The use of transmitting equipment in the immediate vicinity of the unit should be avoided. Evidence of negligence in the care or handling of the instrument may void the manufacturer's warranty. This product contains no serviceable parts. The battery is not intended to be replaced by the operator. The unit should be returned to an authorized **Instantel** service center for service. Any attempt to service this product will void any and all warranties offered by **Instantel**. Service enquiries should be made via your dealer.

CE EC Warning:

This is a Class B product. If this product is not used as outlined within this manual, it may cause radio interference.

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1. BEFORE YOU BEGIN

Before you begin using your new **Series IV** vibration and overpressure monitor, please complete the following. It ensures your monitor is ready for operation and that you become part of **Instantel's Product Support Program**.

Install the **Blastware** software then read the important information in the ReadMe file. See the **Blastware Operator Manual** for installation instructions. For most monitoring operations, setting up and using the monitor is the same for both 4 - Channel and 6 - Channel models, **Minimate Pro4**™ and **Minimate Pro6**™. Where differences do occur, this manual specifies both the four and six channel procedures.

1.1. Check the Package Contents

Please check that you received all the parts identified on your shipping invoice. Remember to keep your shipping box because it was designed to safely ship your monitor back to **Instantel** for calibration and service.

1.2. Record the Minimate Pro Identification Numbers

Record the following identification numbers for future reference:

IDENTIFICATION NUMBERS	
Model Number	
Monitor Serial Number	
Monitor Software Version Number	
ISEE Geophone Serial Number(s)	
DIN Geophone Serial Number(s)	
ISEE Linear Microphone Serial Number	
Dealer Name	
Date Purchased	

1.3. Complete and Return Your Registration Card

Instantel offers the most comprehensive **Product Support Program** available. You receive a two year warranty, product support, and product updates. Your monitor and sensors must be returned to **Instantel** for annual calibration and servicing to maintain your second year warranty. You also receive free software upgrades for your **Minimate Pro** monitor and the **Blastware Compliance** software programs for the first year. All you have to do is complete the registration card included with your **Minimate Pro** and return it to **Instantel** by mail or facsimile within thirty (30) days of purchasing your new monitor. You may also register your product online at: http://www.instantel.com/servicecalibration/warranty.aspx

1.4. Check Your Local Electric Power Supply

Every **Minimate Pro** comes with a 120 VAC, 60 Hz, 16W input AC adapter providing 12 VDC, 1.5A output. An optional 220 VAC adapter is available. Check with your local power utility to ensure the supplied electric power may be used with the **Minimate Pro**. Ask your dealer for information on an optional AC adapter to meet your local requirements.

Note to our Customers in India and other Countries:

Due to large power fluctuations found in countries including India, please use a voltage stabilizer and a 220 V AC Adapter to provide 10 - 14 VDC @ 1.5 A maximum to power the monitor.

1.5. Waste Electrical and Electronic Equipment Directive

For EU countries, this product must be collected and discarded separately from household waste. In an effort to be as gentle as possible on the environment, **Instantel** has embraced the **Waste Electrical and Electronic Equipment Directive** (**WEEE**). This product contains electrical or electronic materials, including batteries. The presence of these materials will have adverse effects on the environment and human health if not disposed of properly. The **WEEE** label on the product means it should not be disposed of as unsorted waste and must be collected separately from household waste, as per legislation under the **WEEE Directive**. Below is the **WEEE** image, which appears on the **Condensed Instructions** label on each unit.

As a consumer, you are responsible for ensuring that this product is disposed of properly. To find out how to properly dispose of this product, please contact the **Instantel Technical Services Department** at *1-613-592-4642* or by e-mail, *service@instantel.com.*

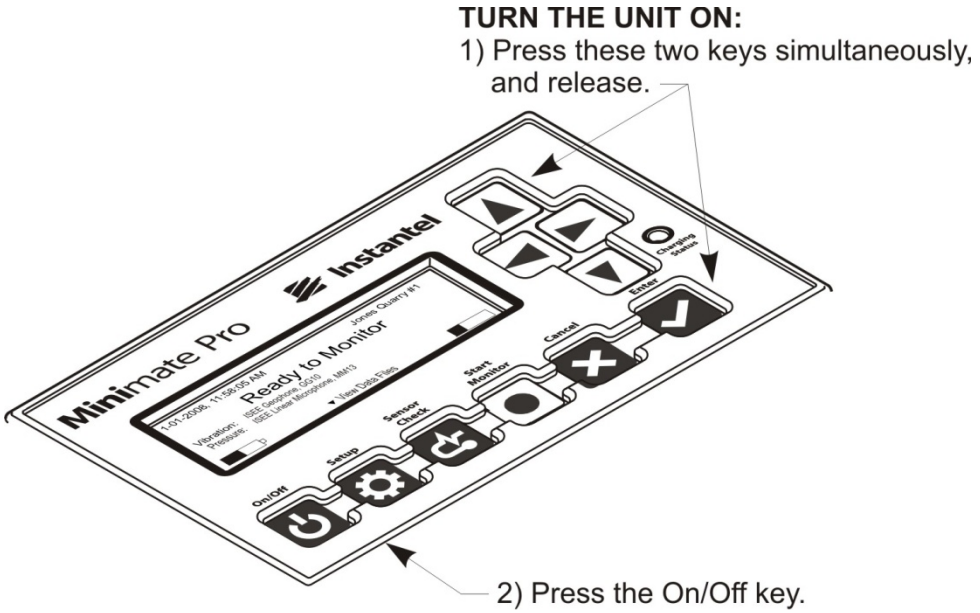
2. BATTERY AND MEMORY OVERVIEW

WARNING: The batteries are not intended to be replaced by the operator, and must only be replaced by an **Authorized Instantel Repair Facility**. The unit should be returned to an authorized **Instantel** service center for service. Any attempt to service this product will void any and all warranties offered by **Instantel**. Service enquiries should be made via your dealer.

The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not disassemble or heat above 100°C (212 °F) or incinerate.

2.1. Activating the Battery

If you have received your **Minimate Pro** directly from **Instantel**, or from an **Authorized Instantel Service and Calibration Facility**, the battery will be deactivated for shipping safety and battery life conservation. Turn the battery on for use or charging by simply plugging in the provided AC Adapter to the unit and an electrical outlet, and pressing the **On/Off** key. If you are in the field or have forgotten your AC Adapter at the office, turn on the unit by pressing the **Up Arrow** and **Enter** keys simultaneously for approximately three seconds, and then press the **On/Off** key while still holding the other two keys. After a few seconds the unit will flash on with the introductory screen, and then the main screen will appear.



NOTE: A **Charging Status** LED is located next to the **Down Arrow** key and indicates the following:

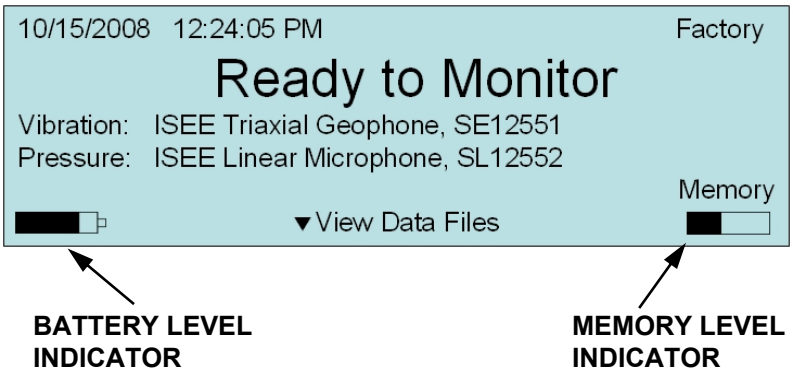
1. **The light is not on –** The charger is not connected to a power outlet, or the charger is malfunctioning.
2. **The light is Yellow –** The charger is connected to a power outlet and is charging.
3. **The light is Green –** The batteries are fully charged.
4. **The light is Flashing Red/Yellow –** The power source is not sufficient (i.e. battery, solar panel, or malfunctioning charger).

2.2. Check the Memory and Battery Status

Always check the **Memory** and **Battery** status levels prior to recording Events or locating the monitor in the field. The **Startup Window** displays the amount of memory and the battery level. **Memory** and **Battery** icons are also located at the lower part of the main display window, which are visible once the unit has started.

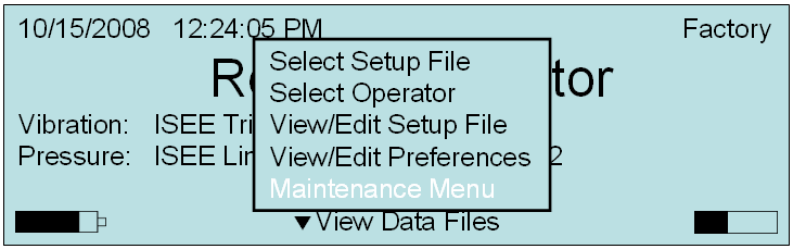
The **Memory** icon displays increments of 25 percent of the total memory, with the black bar increasing as the memory is used.

As well, the **Battery** icon displays the level of the battery in increments of 25 percent of total capacity, with the black bar decreasing as the battery level is depleted.



For accurate text readouts of the **Memory** and **Battery** levels, follow the directions below to access the **About** feature under the **Maintenance** menu:

1. Select the **Setup** key on the unit to access the main setup selection menu. Use **Down Arrow** key and highlight the **Maintenance Menu** item. Press the **Enter** key to select **Maintenance Menu**.



2. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev Setup Maintenance Menu** options. Press the **Right Arrow** key to **Action** a **Maintenance Menu** option. At any time, press the **Cancel** key to return to the previous screen.

a. About

The **About** command opens a new screen that displays the following information:

Model and Serial Number

Firmware Release Number and Date

Calibration Date

Free Memory

Battery Percent

(1) Press the **Right Arrow** key to select the **About** command

(2) Press the **Enter** key to return to the **Maintenance** menu.

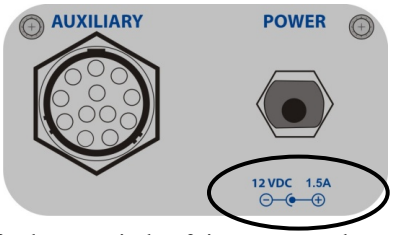
2.3. Battery Instructions

2.3.1. Charging

The **Minimate Pro** internal battery requires regular and periodic charging.

To charge the battery, plug the supplied AC adapter into the connector labeled **Power**, located on the right hand side of the unit. Plug the other end into an electrical outlet. The battery charging indicator light turns on.

Instantel recommends using the 12V, 1.0A AC adapter supplied with each unit, with the description of the required adapter shown below the **Power** connector:



When storing the instrument for long periods of time, ensure that you charge the battery for at least 24 hours and then use the **Disconnect Battery** command within the **Maintenance Menu**.

NOTE: Use of AC adapters that exceed the maximum voltage and current specifications may cause undue stress on the monitor's internal regulators. Like all electronic devices, exceeding these specifications increases the risk of damage and possibly of an accidental fire. The **Instantel** Warranty does not cover this type of damage.

2.3.2. Battery Life

The **Minimate Pro** battery life depends on current draw, aggregate sample rate, battery longevity, and ambient temperature. Review the following information to determine an estimate for battery life.

The nominal battery life for a Minimate Pro unit running in monitor mode is 10 days, at a sample rate of 1024, when in an environment of 25° C (77° F). If the ambient temperature drops to -20° C (-4° F) the battery capacity will also drop to approximately 80% or 8 days. At --40° C (-40° F) the capacity is approximately 50%.

Record Mode	Number of Recording Days at		
	25° C (77° F)	-20° C (-4° F)	-40° C (-40° F)
Waveform	10	8	5
Histogram	3.2	2.5	1.6

The nominal life expectancy of the battery (>70% of initial capacity) is >300 cycles. Li Ion batteries do not experience a memory problem if left on charge all the time. The typical charge retention (>80% of initial charge) is approximately 3 months over a temperature range -20° C (77° F) to 45° C (113° F).

NOTE: Depending upon activity on the Ethernet connection the number of record days could be reduced by 50%. We recommend connecting a unit to the supplied AC adapter or an external 12 VDC power supply for **Histogram** and **Histogram Combo Record Modes**.

LOW TEMPERATURE WARNING:
The internal batteries will not be charged if the ambient temperature is below 0^0C (32^0F) or above 45^0C (113^0F). However, the unit will continue to operate, drawing power from either the internal battery or the external power source, whichever is higher. As a consequence of this, if the unit is operated below 0^0C (32^0F) for an extended period of time, the batteries may eventually become depleted, and the unit will be totally reliant on the external power source.

Notes:

3. HANDLING PRECAUTIONS

- **Handle All Equipment and Accessories with Care**
- **Damaged Equipment**
  Do not operate the equipment if it has been significantly dropped or the casing is damaged. Immediately turn the instrument off and have an **Authorized Instantel Repair Facility** inspect it for possible damage. Do not use the AC Adapter if it is damaged or not fully inserted into the power outlet.
- **Use a proper AC Adapter**
  Use only the recommended **Instantel** AC Adapter. Use of alternate power sources not recommended for this instrument may incorrectly set polarity, cause overheating and/or distortion, fire, electrical shock, or other hazards.
- **Use a proper Electrical Outlet**
  Ensure that the AC Adapter is plugged into a properly rated power outlet. The plug of the AC Adapter varies according to country or region.
- **Do not expose the Adapter** or **Connector to Foreign Objects**
  Do not allow metal objects or dirt to contact the AC Adapter terminal or the plug. Ensure that the plug is clean prior to each use.
- **Keep the Minimate Pro On Charge**
  Always charge the battery when fewer than two graph bars appears in the display or immediately when the **Minimate Pro** beeps. If possible, when not in use, keep the **Minimate Pro** on charge. **Instantel's** supplied charger protects the battery from overcharging.
- **Disconnect the Battery if Storing or Shipping the Minimate Pro**
  If storing for prolonged periods of time, or shipping for calibration or service, disconnect the battery by using the **Maintenance** menu **Disconnect Battery** option – there is no requirement to open the **Minimate Pro**.
- **Always Hold a Cable by its Connector**

  Do not hold the cord to pull on a connector when connecting or disconnecting it.
- **Never Force a Connector**
  Always align the connector to the port before inserting. Ensure you are attaching the Sensor or Auxiliary to the proper connection.
- **Do Not Drop the Minimate Pro** or **Submerge it in Liquids**
  The Minimate Pro is rugged and designed to withstand normal wear and tear. The **Minimate Pro** is water-resistant, designed to withstand temporary exposure to water immersion. Intentionally immersing or installing the monitor in water for prolonged periods of time will damage the monitor.
- **Keep Computer Disks Away from the Geophones**
  The geophones contain magnets that could erase the data stored on computer disks.

Notes:

4. UNIT LABEL INSTRUCTIONS

4.1. Condensed Instructions

Follow the **Condensed Instructions**, as shown below, and also displayed on the unit:

1. Connect the Geophone and/or Microphone sensors to the unit. Position the unit and sensor(s) at the desired locations.
2. Turn the unit on by pressing **On/Off** (**Refer to Note A**).
3. Check the **Battery Status** and **Memory** availability screen. Charge or use the supplied adaptor, as required.
4. When the **Ready to Monitor** screen appears, ensure that your sensor(s) are properly displayed (**Refer to Note B**).
5. To verify or edit **Setups**, press **Setup**. For additional setup information, refer to the **Minimate Operator Manual**.
6. Press **Start Monitor** to enter **Monitoring Mode**.

Note A:

If you have just received the unit, as a new product or from an **Authorized Instantel Service and Calibration Facility**, you must connect the battery by plugging in the **Instantel** AC adapter and pressing the **On/Off** key. You can also connect the battery by simultaneously holding down the **Up Arrow** and **Enter** keys for 3 seconds. While still holding down these keys, press the **On/Off** key.

Note B:

If you change your sensors, it is important to update the system after they are connected by pressing **Sensor Check**.

IMPORTANT:

7. Store the unit on charge when not in use for optimum battery performance.
8. Refer to *Section 7, Basic Tutorial*, for step-by-step instructions to easily begin monitoring with your **Minimate Pro**.

4.2. Battery, Shipping and Warranty Instructions

Prior to shipping the unit to an Authorized **Instantel** Service and Calibration Facility, the battery must be disconnected by deactivating it through the **Minimate Pro** software interface. This is done through a series of key presses, and does not require that the unit be opened. Follow the steps below:

1. Press **Setup**.
2. Select the **Maintenance Menu**.
3. Select **Disconnect Battery** by pressing the **Right Arrow** key; the battery disconnects and the unit turns off.

WARNING: Only use the recommended **Instantel** AC Adapter to maintain optimum battery performance. This product contains no user-serviceable parts. The Operator is **NOT** to replace the battery. For additional information, refer to this manual.

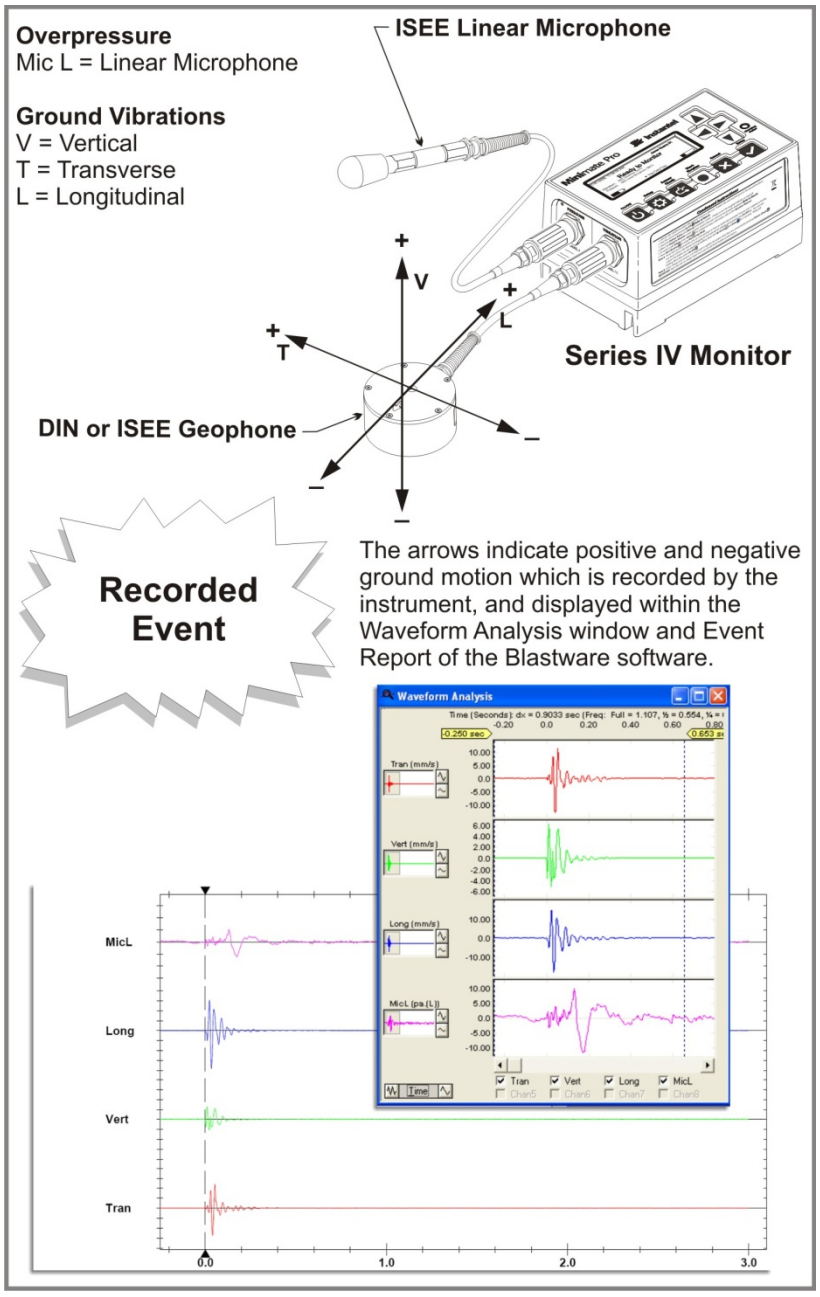
Notes:

5. INTRODUCTION

The **Minimate Pro™** offers advanced monitoring technology with unequaled versatility and flexibility to meet current needs and future requirements. As a smart device, your **Minimate Pro** can be programmed for new features as they are released by **Instantel®** through the **Blastware® Compliance Module**, the software companion provided with your monitor.

The **Minimate Pro** operates as a basic compliance monitor with intuitive functions and ease–of–use to help the first time operator setup and record an Event quickly. The **Minimate Pro** also offers advanced functions for specific applications requiring more information to be collected and analyzed.

5.1. Event Monitoring Example



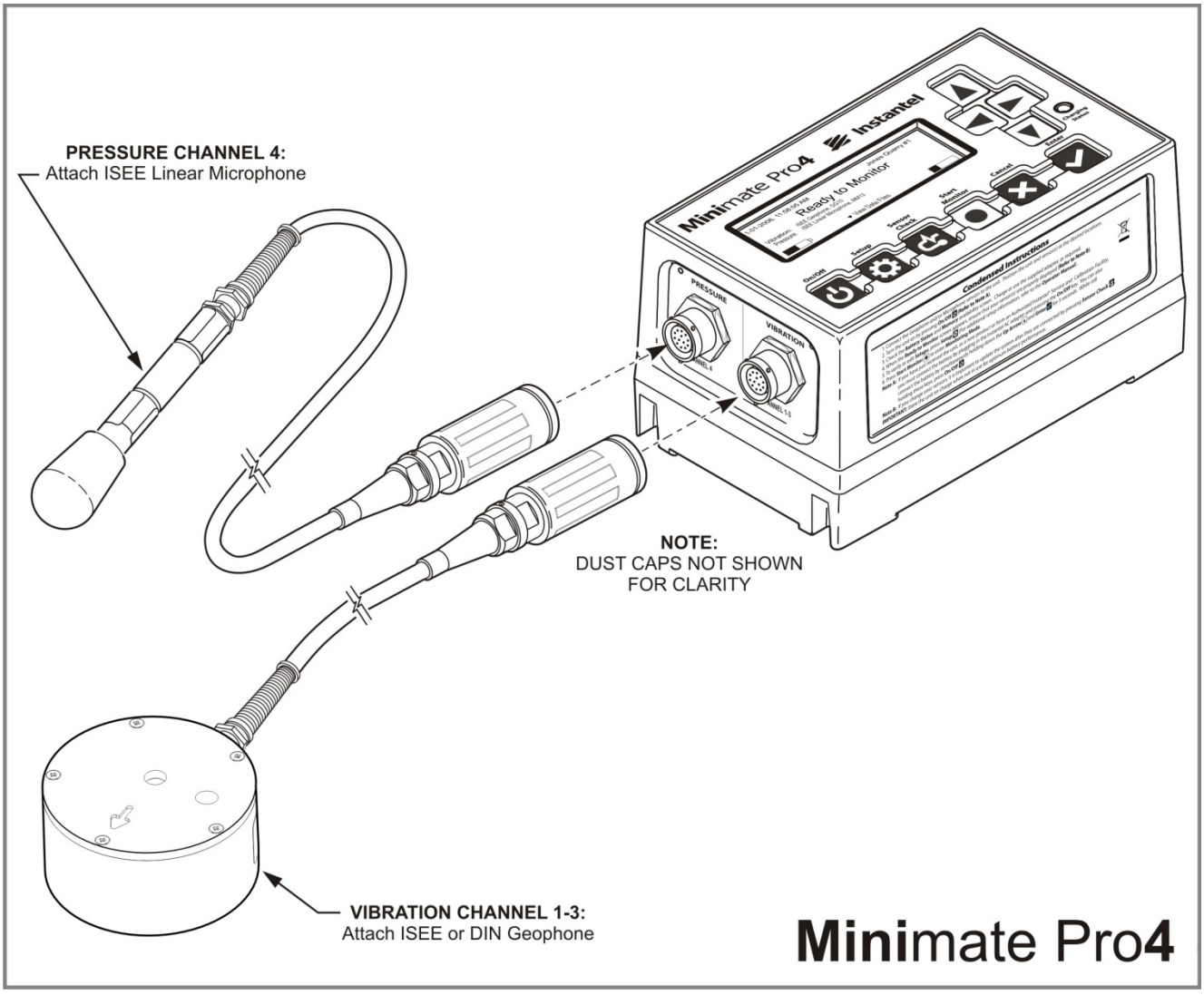
5.1.1. Suggested References

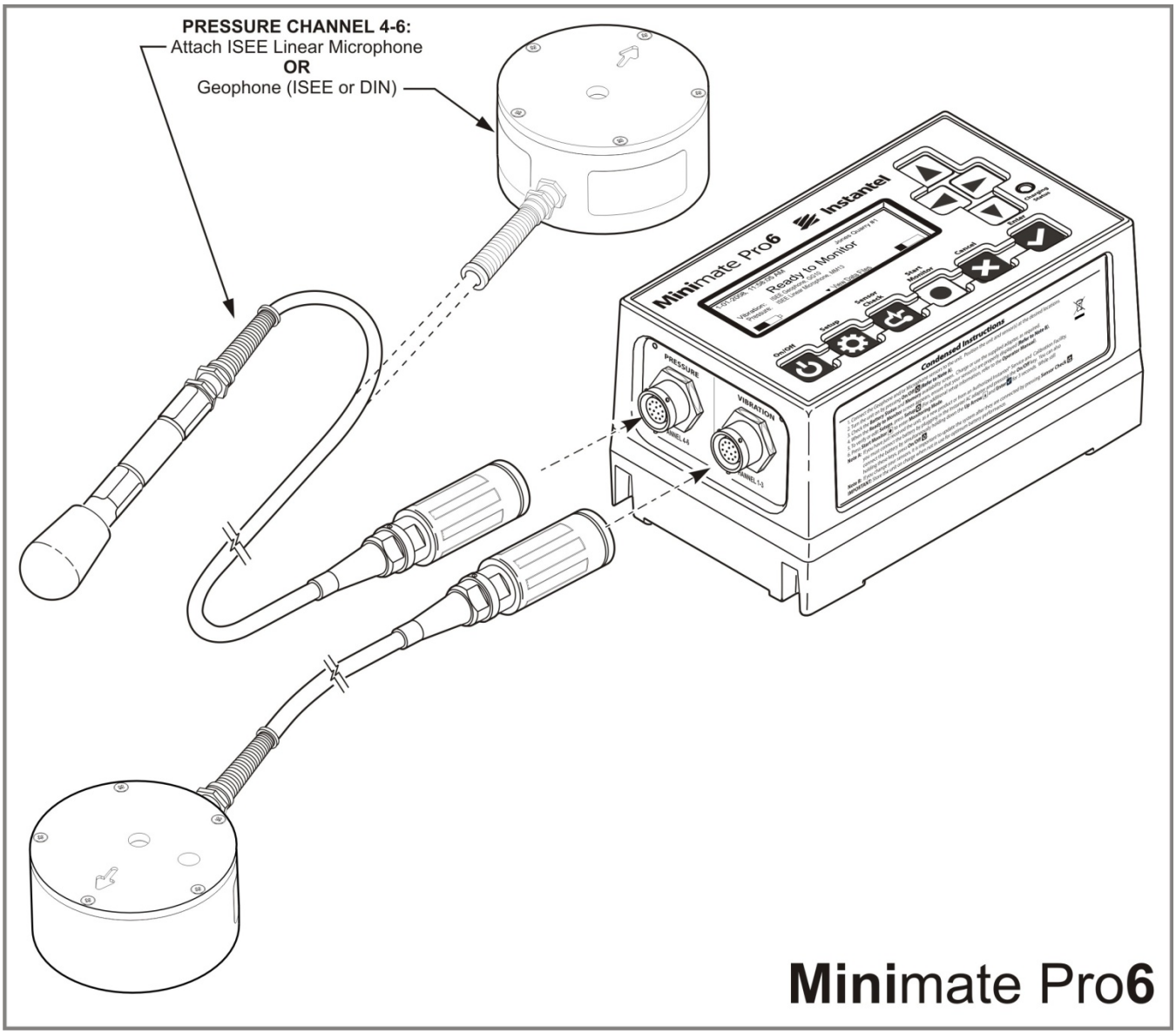
1. ISEE, International Society of Explosives Engineers www.isee.org
2. EFEE, European Federation of Explosives Engineers members.efee-web.eu
3. FMGM, Field Measurement in GeoMechanics www.fmgm.no
4. Vibrations from Blasting, by David E. Siskind, Ph.D., published by ISEE, ISBN 1-892396-11-4
5. The Effects of Vibrations and Environmental Forces, by Lewis L. Oriard, published by ISEE, ISBN 1-892396-10-6
6. Construction Vibrations, by Charles H. Dowding, published by Prentice Hall, ISBN 0-13-299108-X
7. ISEE Blasters' Handbook, 17th Edition. Formerly ETI and DuPont Blasters' Handbook with 14 new chapters added. It can also be used as a study manual or blasting certificate examinations. ISBN1892396009

6. MINIMATE PRO4™ AND MINIMATE PRO6™ MODELS

The **Instantel® Series IV** monitors include two models based on a specific number of recording channels. The **Minimate Pro4** model offers four recording channels and can be set up with one **Series IV** Triaxial Geophone (ISEE or DIN) and an ISEE Linear Microphone. A second model, the **Minimate Pro6**, offers six recording channels with your choice of two Geophones (ISEE or DIN) or a Geophone (ISEE or DIN) and an ISEE Linear Microphone.

An example of each setup is shown below:





6.1. Minimate Pro4 and Minimate Pro6 Comparison

Series IV Instrument	Minimate Pro4	Minimate Pro6
Standard Features:		
Number of Channels	4 Channels (ISEE or DIN Geophone, and an ISEE Linear Microphone)	6 Channels (ISEE or DIN Geophone on both connectors, or an ISEE or DIN Geophone and an ISEE Linear Microphone)
Recording Modes		
Waveform Manual	√	√
Waveform	√	√
Histogram	√	√

Histogram Combo	√	√
Sensors		
ISEE Geophone	√	√
DIN Geophone	√	√
Linear Microphone	√	√
2 Geophones or a Linear Microphone and a Geophone		√
Features		
Sample Rates	512, 1024, 2048, and 4096 S/s per channel	512, 1024, 2048, and 4096 S/s per channel
Memory	64MB	64MB
Storage Capacity (1 sec. @ 1024 sps)	8000-plus 1 second **Event**s at 1,024 S/s sample rate	7100-plus 1 second **Event**s at 1,024 S/s sample rate with two geophones
Water Resistant	√	√
Monitor Log	√	√
Zero Dead Time	√	√
Monitor Scheduler	√	√
Modem Support	√	√
Auto Call Home™	√	√
Ethernet Communications between unit and PC for downloading **Event**s and unit setup. Requires Ethernet Communication Cable, **Minimate Pro** to PC, Part No. 720A4101.	√	√
Optional Features (Refer to the Chapter, Optional Features, in this manual for more information):		
Vibration Dose Value (VDV) Monitor Mode (Requires purchase of **Blastware Advanced Module**)	Available	Available
Wire Break/Make Trigger Cable	Available	Available
Remote Alarm	Available	Available
Series IV Remote Alarm/RS-232 Splitter Cable (for simultaneous use of a modem and an alarm)	Available	Available
GPS (Recommended Garmin® eTrex® GPS)	Available	Available
Ethernet Communications – Real Time Monitoring: view real time display of histogram data. Requires Ethernet Communication Cable, **Minimate Pro** to PC, Part No. 720A4101 (Requires purchase of **Blastware Advanced Module**)	Available	Available
Series IV Class1 Sound Level Microphone	Available	Available

6.2. Minimate Pro Specifications

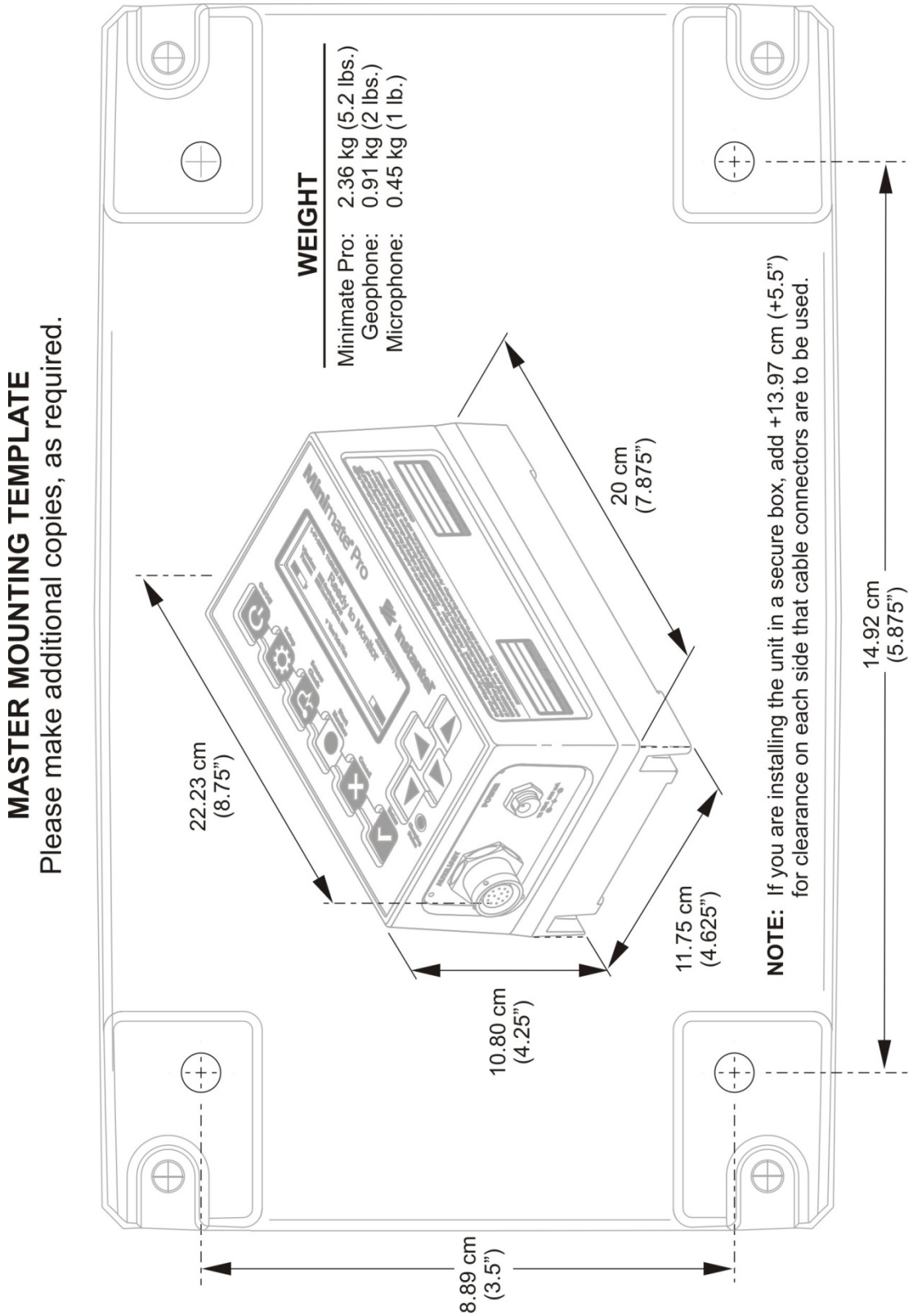
Vibration Monitoring: **ISEE/DIN Geophones**	Range	Up to 254 mm/s (10 in/s)
	Resolution	0.00788 mm/s (0.00031 in/s)
	Accuracy (ISEE/DIN)	+/- 5% or 0.5 mm/s (0.02 in/s), whichever is larger, between 4 and 125 Hz / DIN 45669-1 standard
	Transducer Density	2.13 g/cc (133 lbs/ft^3)
	Frequency Range (ISEE/DIN)	2 to 250 Hz, within zero to -3 dB of an ideal flat response / 1 to 315 Hz / 1 to 80 Hz
	Cable Length	Standard 1.83 m (6 ft), and the DIN Geophone supports custom lengths up to 1 km (0.6 mi).
	Frequency Analysis	National and Local Standards for all countries; refer to features and benefits
	Acceleration, Displacement	Calculated using entire waveform, not estimated at peak.
	Trigger Levels	0.13 to 254 mm/s (0.005 to 10 in/s)
Air Overpressure Monitoring: **ISEE Linear Microphone**	Weighting Scales	ISEE Linear
	Range	88 to 148 dB (500 Pa [0.072 psi] Peak)
	Resolution	0.0155 pa (2.2662×10-6 psi)
	Accuracy	+/- 10% or +/- 1 dB, whichever is larger, between 4 and 125 Hz
	Frequency Response	2 to 250 Hz between -3 dB roll off points
	Trigger Levels	0.00002 – 0.0715 psi in steps of 0.00001 psi (100 – 148 dB)
Sampling Rate		512, 1,024, 2,048, 4,096, 8,192, 16,384, 32,768, 65,536 S/s per channel (independent of record time)
Event Storage – Minimate Pro4	Full Waveform Events	8,000-plus 1 second **Event**s at 1,024 S/s sample rate
Event Storage – Minimate Pro6	Full Waveform Events	7,100-plus 1 second **Event**s at 1,024 S/s sample rate with 2 geophones
Full Waveform Recording	Record Modes	Waveform Manual, Waveform, and programmed Start/Stop.
	Record Time	1 to 9,000 seconds (programmable in one-second steps) plus a 0.25 seconds pre-trigger
	Auto Record™ Time	Event is recorded until activity remains below trigger level for duration of auto window, or until available memory is filled
	Cycle Time	Recording uninterrupted by **Event** processing, monitoring, or communication – no dead time
Histogram	Recording Interval	1 to 30 second intervals, and 30 seconds to 60 minutes at 30 second intervals
	Storage Capacity	800,000 intervals Example: 11.9 days at 2 second intervals, or 355 days at 1 min.
Histogram Combo™	Storage Capacity	Example: 30 days of Histogram recording at 1 minute intervals, and over 6500 1 second waveform **Event**s
Special Functions	Monitor Scheduler	Programmed Start/Stop.
	Scaled Distance	Weight and distance stored with Event.
	Monitor Log	History printout programmable up to all Events stored
	Automatic download	Automatic and remote downloading of data from an unattended monitor with the **Blastware Auto Call Home™** feature
	Measurement Units	Metric or Imperial, dB or Linear Air Pressure
	Location	Log GPS (Global Positioning System) data into record.
User interface	Keyboard	10 domed tactile with separate keys for common functions.
	Display	7-line x 32-character, high-contrast, multi-color backlit LCD
Battery Life		10 Days
Dimensions	Length x Width x Height	22.23 cm (8.75 in) x 11.75 cm (4.625 in) x 10.80 cm (4.25 in)
Weight		2.3 kg (5 lbs)
Warranty	2 Years Parts and Labor	Calibration and equipment check required at 1 year to maintain additional 1 year of warranty.

Environmental		**Ambient Operating Temperature Range**
	LCD	-20 to 45 °C (-4 to 113 °F)
	Electronics	-40 to 45 °C (-40 to 113 °F)
	Battery	-20 to 45 °C (-4 to 113 °F)
	ISEE Microphone	-20 to 50 °C (-4 to 122 °F)
	ISEE and DIN Geophone	-40 to 50 °C (-40 to 122 °F)
	Water Resistance	IPC67 – submerse to 30 cm (1 ft.) for 24 hours
	CE Classification	CE Class B

NOTE: Product specifications are subject to change.

6.3. Minimate Pro Physical Attributes

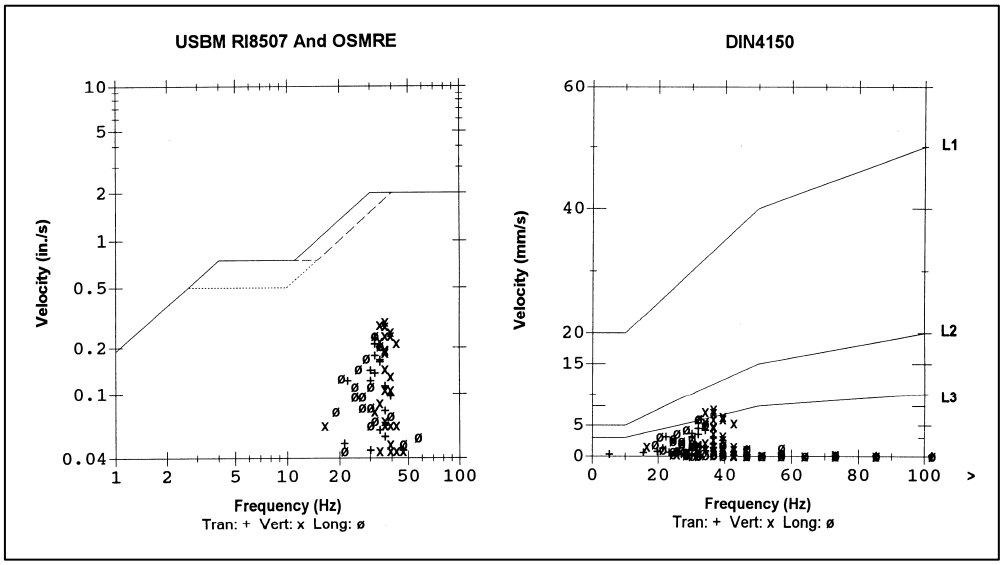
Make additional copies of the image below. It may be used as a template for mounting the unit to a surface or within a security box for long-term or remote monitoring applications.


MASTER MOUNTING TEMPLATE
Please make additional copies, as required.
WEIGHT
Minimate Pro: 2.36 kg (5.2 lbs.)
Geophone: 0.91 kg (2 lbs.)
Microphone: 0.45 kg (1 lb.)
20 cm (7.875")
22.23 cm (8.75")
11.75 cm (4.625")
10.80 cm (4.25")
14.92 cm (5.875")
8.89 cm (3.5")
NOTE: If you are installing the unit in a secure box, add +13.97 cm (+5.5") for clearance on each side that cable connectors are to be used.

6.3.1. Features and Benefits

The **Minimate Pro** offers outstanding features unequaled in the industry. The following lists some of the features. Please see the specifications located in the Appendix of this manual for a complete list.

- **Two Year Warranty –** Full two year parts and labor warranty on the monitor. A calibration and equipment check at the one year mark is required to ensure continued reliable performance and the second year of the warranty.
- **Full Waveform Event Capacity –** For **Minimate Pro4**, 8000-plus 1 second **Event**s at 1,024 S/s sample rate. For **Minimate Pro6** with two geophones, 7100-plus 1 second **Event**s at 1,024 S/s sample rate.
- **Personal and Job Specific Information –** Customize how your monitor works with saved **Setups**, **Notes**, **Name** and **Location** information.
- **Keypad –** Large 10-key interface helps you navigate through the simple menu structure. **Manual Record Mode** is at the tip of your finger, as are the **Setup** and **Sensor Check** features.
- **Large Backlit Display –** Large display and characters for easy reading; you choose the backlight color option and timeout settings for battery conservation.
- **Intuitive Interface –** Graphic icons keep you informed of battery and memory levels, and dynamic display of **Peak Vibration**, **Zero Crossing Frequency**, and **Peak Overpressure** in imperial or metric units keeps you informed as Events occur.
- **Multiple Record Modes –** Offers you unlimited flexibility during monitoring operations with **Manual Waveform**, **Waveform**, **Histogram** and **Histogram Combo** with programmed start/stop recording options. Optional **Vibration Dose Value** (**VDV**) with the purchase of **Blastware Advanced Module**.
- **Full Waveform Event Analysis –** Full field analysis of the Event including **Peak Particle Velocity** (**PPV**), **Peak Air** (sound), **Pressure**, **Peak Vector Sum** (**PVS**), **Peak Acceleration**, and **Peak Displacement**. For any Event, view **Operator**, **Trigger Levels**, **Duration**, **Max Vibration** and **Overpressure**, **ZC Frequency**, and **Sensor Check** information right on the monitor.
- **National Frequency Analysis Standards –** The **Minimate Pro** supports numerous Compliance Reports, also called National Frequency Analysis Standards. Two frequency standards, U.S.A. USBM/OSMRE and German DIN 4150, appear in the image below. Use the **Blastware** software to choose the Compliance Report used by the monitor.



NOTE: Data points appearing outside of the report indicate the recorded data was outside the range of the report. In the DIN 4150 example, some peaks occurred at frequencies greater than 100 Hz and were therefore drawn outside the boundaries of the report.

A list of National Frequency Standards included with Blastware:

National Frequency Analysis Standards
Australian Standard – 2187.2-1993
Australian Standard – QLD APP Standard
British Standard – 6472: 1992 Curve 128
British Standard – 6472: 1992 Curve 16
British Standard – 6472: 1992 Curve 20
British Standard – 6472: 1992 Curve 32
British Standard – 6472: 1992 Curve 60
British Standard – 6472: 1992 Curve 8
British Standard – 6472: 1992 Curve 90
Czech Standard
Denmark Standard – Harmoniska Svangningar
European Standard – DIN4150
French – Ministere Environnement
French – Foction de Ponderation
Generic Graph – Add New Title
India – DGMS [A]
India – DGMS [B]
India – Bureau of Standards
Metric Response Spectrum
India – Proposed CMRI
New Zealand Standard – 4403:1976
New Zealand Standard / ISO – 2631-2-1989 Combined Curves
Slovak Standard
Spanish Standard– Criterio Prevencion 22.381
Swiss Standard – Mining Standard SN 640 312a
Swiss Standard – Piling Standard SN 640 312a
Swiss Standard – Traffic Standard SN 640 312a
USBM Standard – RI8507 and OSMRE

- **Ethernet Communications** – Download **Event** data from the unit. Upload setup files. Purchase the **Blastware Advanced Module** to view histogram data in real time.
- **Remote Connectivity** – Use the **Auto Call Home™** program for easy, remote access to your monitor and data, using Serial or IP communications. Whenever an **Event** occurs, the monitor automatically places a call to your PC and downloads **Event** data into a central location on your hard disk drive. When the monitor is ready to call in, it switches its modem on, and dials in to your PC. When communication has been established, the PC checks the serial number of the monitor, and then executes the instructions you have set for that specific monitor. Once data has been downloaded, the PC terminates communication.

  To use this feature, a telephone (cellular or satellite), modem connection to your **Minimate Pro** monitor, a PC equipped with a free serial port, and the Microsoft® Windows® operating system are required. For the **Auto Call Home** Serial Communications option, each communications port used on the PC must also have a modem. Please refer to the **Blastware Operator Manual** for more information on how to set up the **Auto Call Home** feature.
- **Wire Break/Make Trigger Cable** – Use the optional external wire **Break** or **Make** connected to the Auxiliary Connector to trigger the unit at the same time as the Event occurs or connect up to six units for a primary/secondary triggering configuration. Trigger within 1 sample (**Example:** 1 ms at 1024 or ¼ ms at 4096).
- **Full PC Compatibility –** Archive, print, perform analysis and processes with **Blastware** software modules, and additional features within the **Blastware Advanced Module**:

Processes	Tools
View History	Scaled Distance
Add	Post Event Notes
Subtract	ASCII Conversion
Shift	Human Exposure Report
Truncate	Compliance Graph Editor
Vector Sum	Language Editor
Integrate	Edit Timeline
Differentiate	Scale Graphs
Filter	Remove Channel
Scale	Ponderation
Remove Offset	Human Exposure
FFT Analysis	Transfer Function
Test Wave	Export Channel Data
Peak Hold	
Smooth	

- **Variable Sample Rates – 512**, **1024**, **2048**, and **4096 KHz** for each channel.
- **Minimate Pro6™** – Offers the capability of two vibration recording points. This feature allows you to attach either an ISEE Microphone and a DIN or ISEE Geophone, or two DIN or ISEE Geophones.
- **Rugged Design** – Field rugged and durable design with a fully sealed top panel, non–corrosive industrial grade connectors, and sealed electronics to enhance water resistance. **Series IV** monitors offer an added level of EMI shielding, built-in noise and anti-aliasing filtering; both sensor ports are isolated from the ground.

6.4. Unit and Accessory List

Instantel's complete line of **Minimate Pro** units and related accessories:

Part No.	Item	Description
720A2301	**Minimate Pro4**	4-Channel Unit
720A2401	**Minimate Pro6**	6-Channel Unit
714A4501	**Blastware Advanced Module**	Event Manager, reporting, and advanced analyis.
720A2001	ISEE Geophone	2 to 250 Hz frequency response. An additional **Series IV** ISEE Geophone may be purchased and used on the Pressure Channel, 4-6, of the **Minimate Pro6**.
720A2002	DIN Geophone	1 to 315 Hz frequency response. An additional **Series IV** DIN Geophone may be purchased and used on the Pressure Channel, 4-6, of the **Minimate Pro6**.
720A2003	DIN Geophone	1 to 80 Hz frequency response. An additional **Series IV** DIN Geophone may be purchased and used on the Pressure Channel, 4-6, of the

		Minimate Pro6.
720A1801	ISEE Linear Microphone	Linear “L” Microphone for air pressure measurements.
720A5101	Sound Level Microphone	Record unattended monitoring of noise, such as building activities, construction, traffic, and mining operations.
714A1801	ISEE Geophone Leveling Plate	With adjustable leveling feet and integrated bubble level. Used to mount the ISEE Geophone to a wall or ceiling as well as ground installations.
1712	Microphone Windscreen	Reduce false triggering caused by wind by installing the fitted foam covering over the microphone sensor.
714A3401	Microphone Stand Assembly	3-part threaded alloy stand for mounting and elevating the Linear Microphone.
720A3901	Remote Alarm Controller	The unit can trigger a local audible and/or visual alarm through the **Auxiliary I/O** port.
720A4001	**Series IV** Remote Alarm/ RS-232 Splitter Cable	Connect a Remote Alarm and Modem to the unit simultaneously.
720A3101	RS-232 Communication Cable	Connect a **Series IV** instrument to a 9-pin serial port on the PC.
71407001	USB Serial Adaptor Cable	Use a USB Adaptor to connect to the Serial communication cable and a USB port on the PC.
720A3501	Wire Break/Make Trigger Cable	Trigger up to six **Minimate Pro** units; a **Wire Break/Make Trigger Cable** is required for each unit to be triggered. The monitor’s Auxiliary Channel senses the wire trigger signal via a 20 gauge **Make** or **Break** wire provided by the operator, and starts recording. Refer to the Chapter, Optional Accessories, this manual, for more information.
720A3301	**Series IV** Extension Cable, 30.5 m (100 ft.)	**Series IV** extension cable with connectors for ISEE and DIN Geophones, and ISEE Linear Microphone sensors.
720A3302	**Series IV** Extension Cable, 76.2 m (250 ft.)	**Series IV** extension cable with connectors for ISEE and DIN Geophones, and ISEE Linear Microphone sensors.
720A3305	**Series IV** Extension Cable, Custom Length	Must be purchased with connectors and assembly and a specific length of extension cable (Part No.

		301-000034-000).
301-0000 34-000	**Series IV** Extension Cable, Custom Length	Up to 1 km (.62 Miles) supported **Series IV** extension cable for the DIN Geophones. Must be purchased with connectors and assembly (Part No. 720A3305)
720A3801	**Series IV** Extension Cable, Connector Kit	Male and Female connectors only. Customer to supply and build cables
714A2401	Auto / 12 V Adapter	Connect the **Minimate Pro** to your vehicles 12 volt power supply or a 12 volt battery for remote installations.
370-000002-000	PS-12/1.0	12V, 1.0A AC. For use with **Series IV** units.
720A3601	Null Modem Cable	Cable for connecting a U.S. Robotics modem to a **Series IV** unit.
720A3401	Null Modem Cable	Cable for connecting a CDMA AirLink Raven modem to a **Series IV** unit.
720O2101	Accessory and Unit Carrying Case	Optional Carrying Case is available to protect and store your equipment during transfer and storage.
720A4101	Ethernet Communication Cable, **Minimate Pro** to PC	For Ethernet Communications

6.5. Unit Keypad and Menu Navigation Overview

Before starting the *Basic Tutorial, Section 7*, familiarize yourself with the following two Subsections, **Unit Keypad Overview** and **Unit Menu Navigation**.

6.5.1. Unit Keypad Overview

The display has a variety of commands used to navigate the menus, enter or edit data, or perform actions. Use the keys of the of the **Minimate Pro** to navigate through the menus, perform a **Sensor Check**, enter the **Setup** menu, and **Start Monitor** for manually recording Events.

Key	Symbol	Associated Commands
On/Off		Turn the monitor display **On** or **Off**.
Setup		Access the Main Menu.
Sensor Check		Perform a **Sensor Check**.
Start Monitor		Manual start key to monitor an Event
Cancel		**Cancel**, Back, or Exit.
Enter		**Enter**, Save, Accept, Menu.
Up/Down Arrows		Next/Prev, Scroll through Menus, or Text Entry. Hold down to scroll quickly.
Right Arrow		Edit, Action, Add, Detail, or Text Entry.
Left Arrow		Navigate Text Fields
Down Arrow		Levels Off, View Data Files, Last Event
Key Combination		Use this sequence to connect the battery and turn the unit on without an AC Adapter

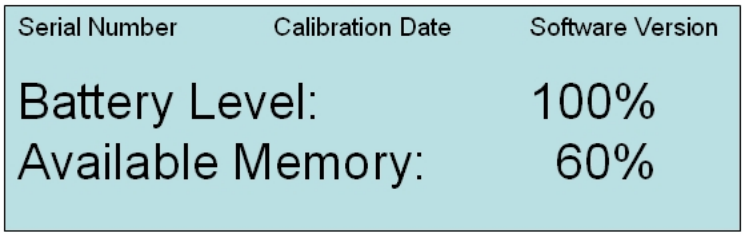
Status Light

A **Charging Status** LED is mounted next to the **Down Arrow** key and indicates the following:

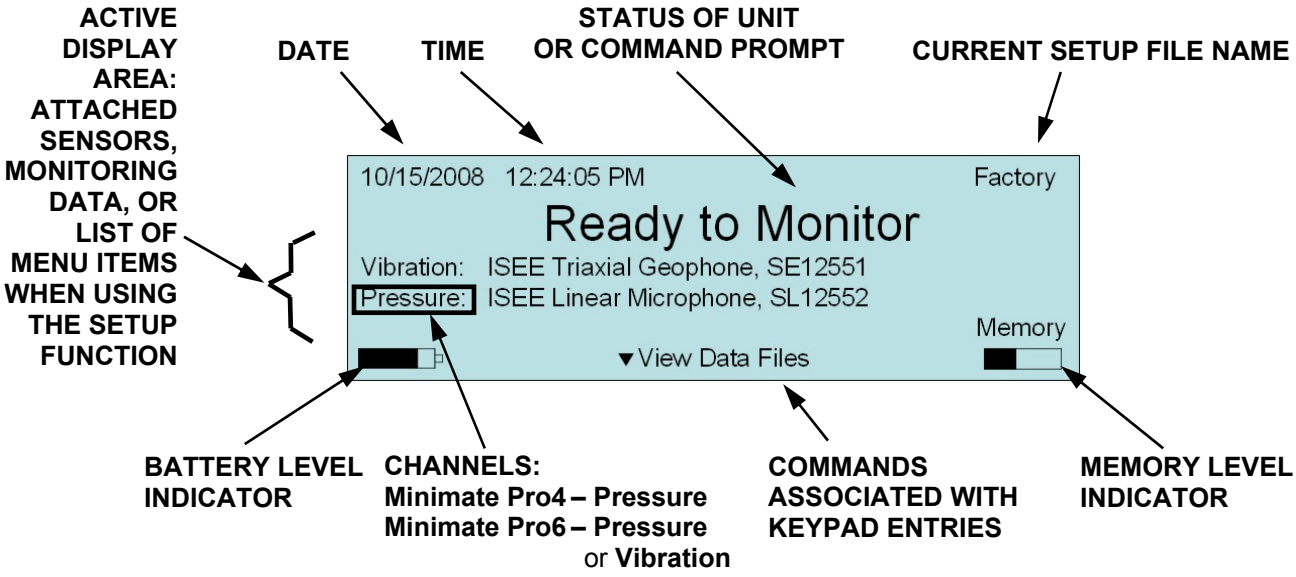
1. **The light is not on –** The charger is not connected to a power outlet, or the charger is malfunctioning.
2. **The light is Yellow –** The charger is connected to a power outlet and is charging.
3. **The light is Green –** The batteries are fully charged.
4. **The light is flashing Red/Yellow –** The power source is not sufficient (i.e. battery, solar panel, or malfunctioning charger).

6.5.2. Unit Menu Navigation Overview

1. When the **Minimate Pro** is initially turned on, the following two screens appear after a few seconds:

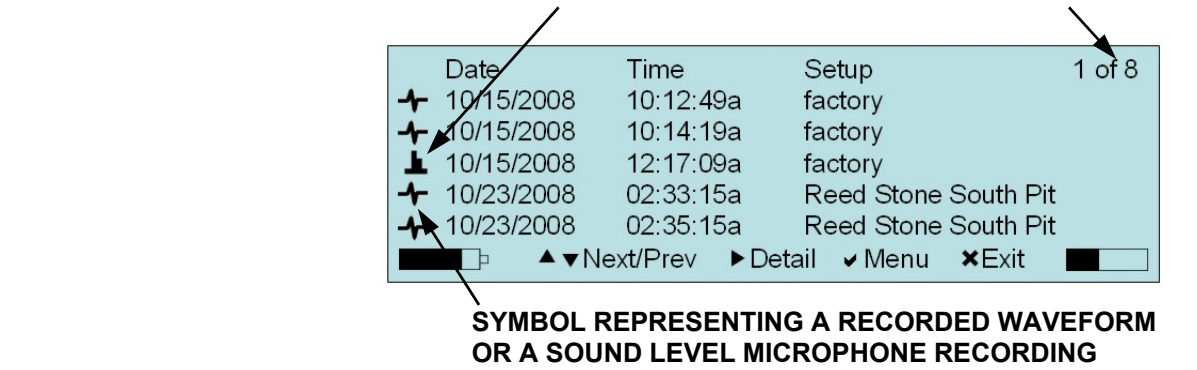


2. These two screens are followed by the **Main Display** Screen:

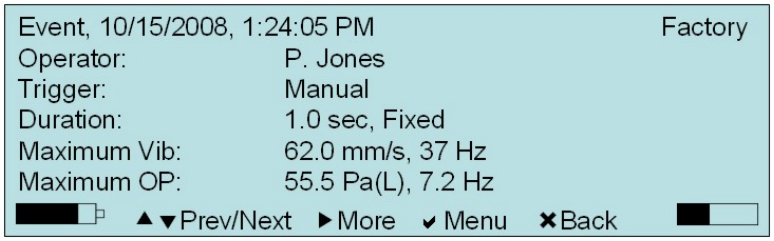

ACTIVE DISPLAY AREA: ATTACHED SENSORS, MONITORING DATA, OR LIST OF MENU ITEMS WHEN USING THE SETUP FUNCTION
DATE
TIME
STATUS OF UNIT OR COMMAND PROMPT
CURRENT SETUP FILE NAME
10/15/2008 12:24:05 PM
Factory
Ready to Monitor
Vibration: ISEE Triaxial Geophone, SE12551
Pressure: ISEE Linear Microphone, SL12552
Memory
▼View Data Files
BATTERY LEVEL INDICATOR
CHANNELS: Minimate Pro4 – Pressure Minimate Pro6 – Pressure or Vibration
COMMANDS ASSOCIATED WITH KEYPAD ENTRIES
MEMORY LEVEL INDICATOR

3. Entering or editing text for items such as **Locations**, **Operators**, **Company** and **General Notes** are all performed within an editing screen. Press the **Up** or **Down Arrow** to scroll through the upper and lower case characters, numerical, and special characters. Press the **Right** and **Left Arrows** to move to and from each character location for editing. Press the **Enter** key to **Save** the changes, or the **Cancel** key to return to the previous menu without saving the changes.

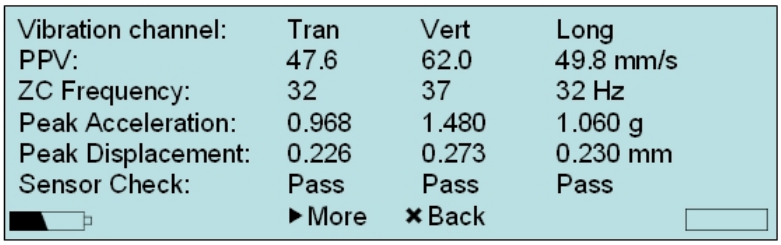
4. Within the **View Data** window, each Event that is recorded with a particular recording option, **Waveform** or **Histogram**, and has a different icon representing the data to help you determine the type of Event:



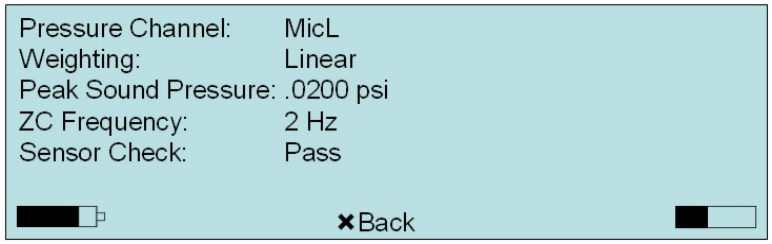
a. Within the **View Data** window, select the **Right Arrow** key to display the **Detail** of a selected **Waveform** Event. Below is an example of the **Detail** feature for a ***Waveform Event***:



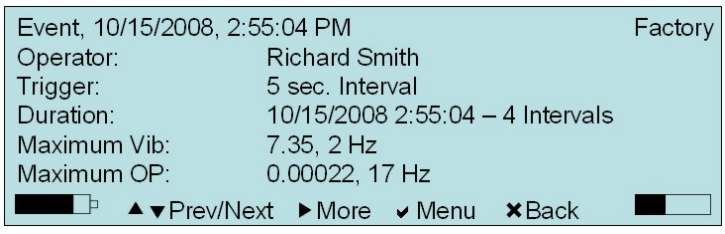
i. Press the **Right Arrow** key to review more data associated with the selected Event. Click the **Up** or **Down Arrow** to view the **Prev/Next Event** data, or the **Cancel** key to go **Back** to the previous menu:


Vibration channel: Tran Vert Long
PPV: 47.6 62.0 49.8 mm/s
ZC Frequency: 32 37 32 Hz
Peak Acceleration: 0.968 1.480 1.060 g
Peak Displacement: 0.226 0.273 0.230 mm
Sensor Check: Pass Pass Pass
▶More
✖Back

ii. Press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:



b. Within the **View Data** window, select the **Right Arrow** key to display the **Detail** of a selected **Histogram** Event. Below is an example of the **Detail** feature for a ***Histogram Event***:



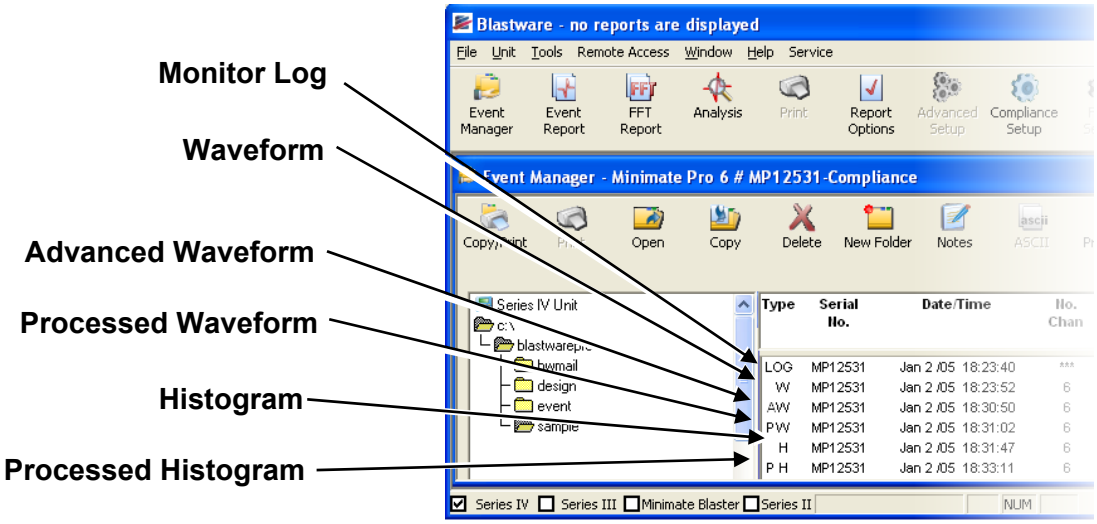
i. Press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:

Vibration channel:	Tran	Vert	Long
PPV:	7.35	0.131	7.16 in./s
ZC Frequency:	2	18	2 Hz
Peak Acceleration:	1.62	0.104	1.07 g
Peak Displacement:	0.534	0.00679	0.445 inch
Sensor Check:	Pass	Pass	Pass
	▶More	✖Back	

ii. Press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** to go **Back** to the previous menu:

Pressure Channel:	MicL
Weighting:	Linear
Peak Sound Pressure:	0.00022 psi
ZC Frequency:	17 Hz
Sensor Check:	Pass
	✖Back

5. When these different types of recorded **Event**s are transferred to the **Blastware Event Manager**, each one is given a specific character to denote the **Type** of file it is, as indicated below:

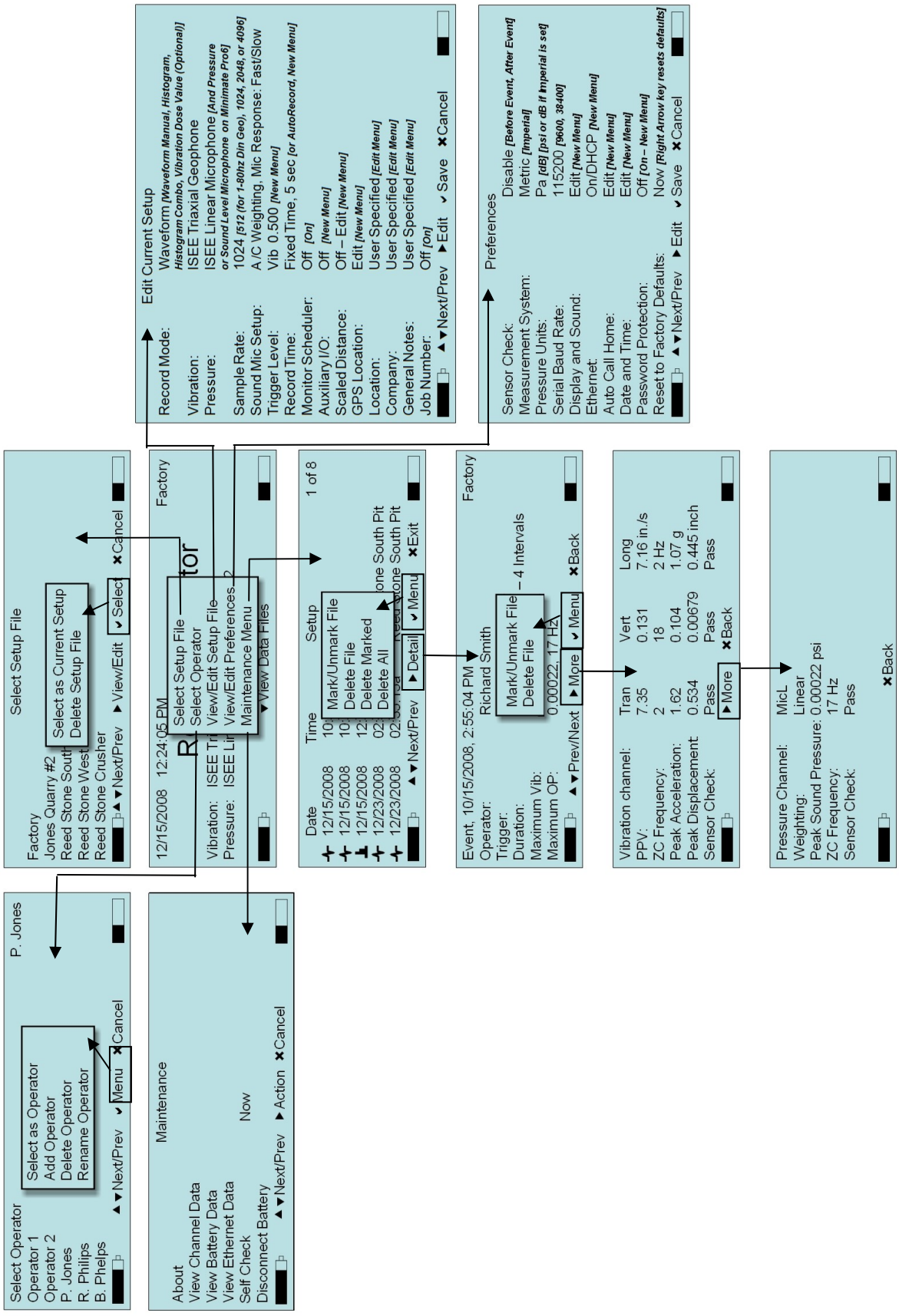


NOTE: In the picture above, two Events have a "**P**" as part of their designation – this indicates that the Event was copied and subsequently 'Processed' by using the Tools and/or Process features of the **Blastware** software.

NOTE: The **LOG** file type is a history of the monitoring activity; double-clicking on this file type will display the associated **Monitor Log** information.

6. Below is a display of the top level menu items and paths:

   NOTE: The settings and data may vary, dependent on the **Setup File** used or **Event** viewed.


Select Operator
Operator 1
Operator 2
P. Jones
R. Philips
B. Phelps
▲▼Next/Prev
✔Menu
✖Cancel
Select as Operator
Add Operator
Delete Operator
Rename Operator
P. Jones
Maintenance
About
View Channel Data
View Battery Data
View Ethernet Data
Self Check
Disconnect Battery
Now
▲▼Next/Prev
▶Action
✖Cancel
Select Setup File
Factory
Jones Quarry #2
Reed Stone South
Reed Stone West
Reed Stone Crusher
Select as Current Setup
Delete Setup File
▲▼Next/Prev
▶View/Edit
✔Select
✖Cancel
12/15/2008 12:24:05 PM
Factory
Select Setup File
Select Operator
View/Edit Setup File
View/Edit Preferences
Maintenance Menu
View Data Files
Vibration: ISEE Tr
Pressure: ISEE Lin
Date
Time
Setup
1 of 8
12/15/2008
12/15/2008
12/15/2008
12/23/2008
12/23/2008
Mark/Unmark File
Delete File
Delete Marked
Delete All
one South Pit
Reed Stone South Pit
▲▼Next/Prev
▶Detail
✔Menu
✖Exit
Edit Current Setup
Record Mode:
Waveform [Waveform Manual, Histogram, Histogram Combo, Vibration Dose Value (Optional)]
Vibration:
ISEE Triaxial Geophone
Pressure:
ISEE Linear Microphone [And Pressure or Sound Level Microphone on Minimate Pro6]
Sample Rate:
1024 [512 (for 1-80hz Din Geo), 1024, 2048, or 4096]
Sound Mic Setup:
A/C Weighting, Mic Response: Fast/Slow
Trigger Level:
Vib 0.500 [New Menu]
Record Time:
Fixed Time, 5 sec [or AutoRecord, New Menu]
Monitor Scheduler:
Off [On]
Auxiliary I/O:
Off [New Menu]
Scaled Distance:
Off – Edit [New Menu]
GPS Location:
Edit [New Menu]
Location:
User Specified [Edit Menu]
Company:
User Specified [Edit Menu]
General Notes:
User Specified [Edit Menu]
Job Number:
Off [On]
▲▼Next/Prev
▶Edit
✔Save
✖Cancel
Preferences
Sensor Check:
Disable [Before Event, After Event]
Measurement System:
Metric [Imperial]
Pressure Units:
Pa [dB] [psi or dB if Imperial is set]
Serial Baud Rate:
115200 [9600, 38400]
Display and Sound:
Edit [New Menu]
Ethernet:
On/DHCP [New Menu]
Auto Call Home:
Edit [New Menu]
Date and Time:
Edit [New Menu]
Password Protection:
Off [On – New Menu]
Reset to Factory Defaults:
Now [Right Arrow key resets defaults]
▲▼Next/Prev
▶Edit
✔Save
✖Cancel
Event, 10/15/2008, 2:55:04 PM
Factory
Operator:
Richard Smith
Trigger:
Mark/Unmark File
Delete File
– 4 Intervals
Duration:
Maximum Vib:
Maximum OP:
0.00022, 17 Hz
▲▼Prev/Next
▶More
✔Menu
✖Back
Vibration channel:
Tran
Vert
Long
PPV:
7.35
0.131
7.16 in./s
ZC Frequency:
2
18
2 Hz
Peak Acceleration:
1.62
0.104
1.07 g
Peak Displacement:
0.534
0.00679
0.445 inch
Sensor Check:
Pass
Pass
Pass
▶More
✖Back
Pressure Channel:
MicL
Weighting:
Linear
Peak Sound Pressure:
0.00022 psi
ZC Frequency:
17 Hz
Sensor Check:
Pass
✖Back

7. OPTIONAL FEATURES

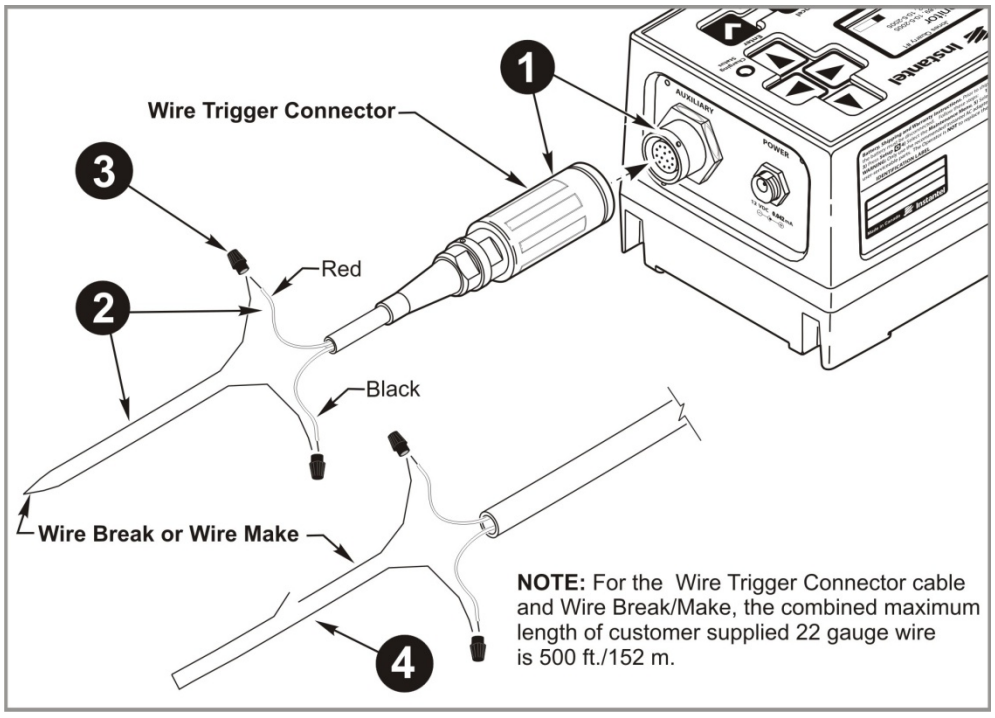
7.1. Wire Break/Make Trigger Cable [Optional]

The optional **Wire Break/Make Trigger Cable** (Part No. 720A3501) for the **Series IV** units is available for purchase from your authorized **Instantel Dealer Representative** and is shipped with an installation and setup sheet. The **Wire Break/Make Trigger Cable** is used to trigger up to six **Minimate Pro** units; a **Wire Break/Make Trigger Cable** is required for each unit to be triggered.

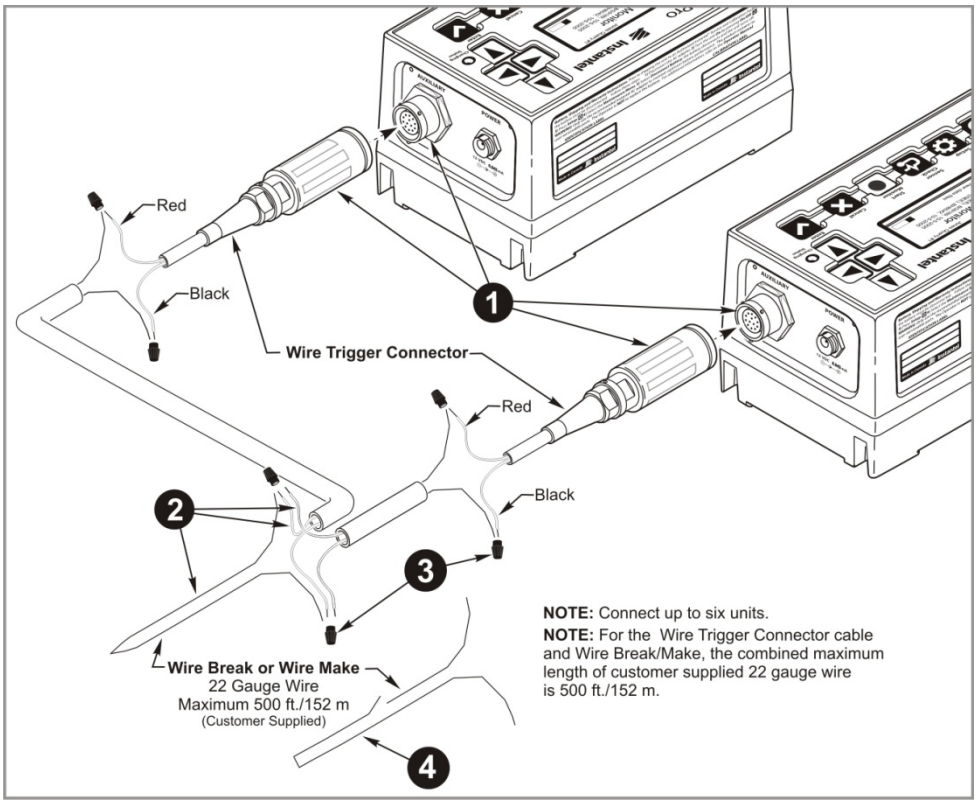
The units auxiliary channel senses the wire trigger signal via a 22 gauge **Break** or **Make** wire provided by the operator, and starts recording. A signal occurs when the **Break** or **Make** trigger wires separate or create a contact, **a)** a **Break** signal from a blast physically breaking the trigger wire, or **b)** a **Make** signal occurs when the trigger wires contact, such as an operator pressing a push button switch.

Tools and Materials Required:

1. **Series IV** Unit(s) – up to six units may be connected
2. **Wire Break/Make Trigger Cable**, one for each unit (Part No. 720A3501), with instructions
3. Red and Black 22 Gauge Wire, up to 500 ft./152 m
4. Wire Strippers
5. A Two-way Switch, for each **Make** trigger setup
6. Electrical tape, as required


1
Wire Trigger Connector
3
Red
2
Black
Wire Break or Wire Make
4
NOTE: For the Wire Trigger Connector cable and Wire Break/Make, the combined maximum length of customer supplied 22 gauge wire is 500 ft./152 m.

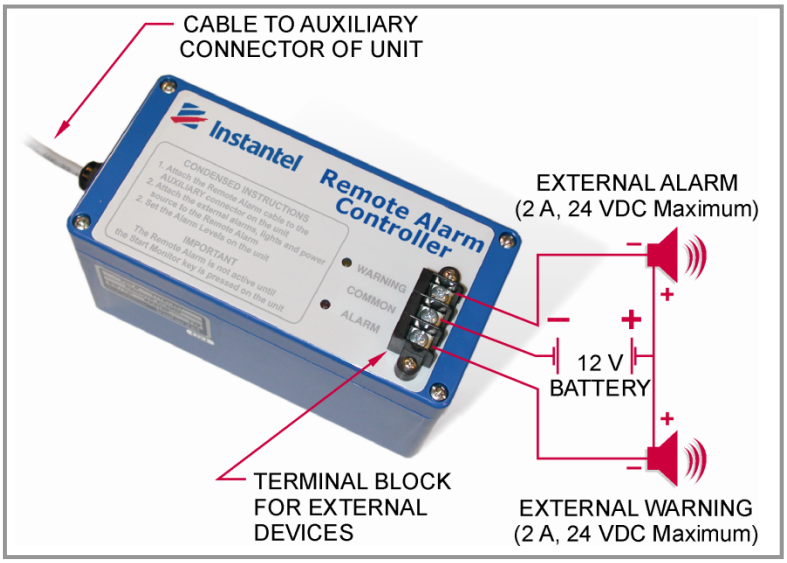
Single Wire Break/Make Trigger Cable Setup



Multiple Wire Break/Make Trigger Cable Setup

7.2. Remote Alarm [Optional]

The optional **Remote Alarm** (Part No. 720A3901) for the **Series IV** units is available for purchase from your authorized **Instantel Dealer Representative**, and is provided with an installation instruction sheet.



The **Remote Alarm Controller** indicates normal and over-triggering at a remote site. Use an optional extension cable to extend the length of the input cable; the output from the terminal block of the **Remote Alarm Controller** box can be used to run long distances to drive an external alarm.

The **Alarm Levels** within the monitor setup menu controls the triggering of the **Remote Alarm Controller** based on the levels set for **Vibration** or **Pressure**. The remote alarm sounds two alarms: ***warning*** and ***alarm***. The warning alarm sounds when Event activity exceeds the **Vibration Level** or **Pressure Level**. The **Vibration Alarm Level** and/or the **Pressure Alarm Level** can be set to a higher level than the **Geophone Trigger Level** and the **Pressure Trigger Level**. This allows for the triggering of a second alarm at the higher level.

For example, in pile driving operations the remote alarm triggers a warning when activity exceeds the trigger level for the geophone, notifying the operator that the pile driving activity has exceeded the set level. The second alarm triggers when activity exceeds the **Vibration Alarm Trigger Level**, set to a higher level, notifying the operator that operations should cease immediately.

Tools and Materials Required:

1. **Series IV** Unit
2. **Remote Alarm Controller** (Part No. 720A3901), with instructions
3. External Alarm with power source (required - not supplied)
4. Optional **Series IV Remote Alarm/RS-232 Splitter Cable**. Used when both a **Remote Alarm Controller** and a modem must be connected to the monitor at the same time (Part No. 720A4001)
5. Optional **Series IV Extension Cable, Connector Kit** (Part No. 720A3801)

7.3. View Real Time Histogram Data [Optional]

View **Histogram** data in real time over the Internet with **Ethernet®** connectivity, is available with the purchase of the **Blastware Advanced Module**, and the **Ethernet Communications** option. Contact your authorized **Instantel Dealer Representative** for more information. **Ethernet** is a high-speed network standard of communication protocol that is primarily used for Local Area Networks (LAN) to connect end-systems, in this instance, the **Series IV** units to a network.

To use this feature, a telephone (cellular or satellite), modem connection to your **Minimate Pro** monitor, a PC equipped with a free **Ethernet** port or router, and the Microsoft® Windows® operating system are required. The speed of the data transfer will be determined by the connection quality and supported rate.

Tools and Materials Required:

1. **Series IV** Unit
2. **Blastware Advanced Module**
3. **Ethernet Communications Cable**
4. **Ethernet** Connectivity Hardware (required – not supplied)

7.4. Vibration Dose Value (VDV) [Optional]

The optional **Vibration Dose Value** (**VDV**) **Record Mode** is available with the purchase of the **Blastware Advanced Module** software. If you have a licensed copy of the **Blastware Advanced Module**, follow the instructions in the **Blastware Operator Manual** for **Reloading the Operating System** of the **Minimate Pro**, which will load the **VDV** feature into the unit. To order your copy of the **Blastware Advanced Module**, please contact your **Instantel Dealer Representative**.

The **VDV** monitoring option is used to measure and determine whole-body vibration based on a **Frequency Weighting** file that is downloaded from **Blastware**. Your geographic location and the type of vibration that you are monitoring will determine which **Frequency Weighting** file that you choose to use during the monitoring session – the frequency range of the data collected is from 1 to 80 Hz. Two frequency weighting files may be downloaded to the monitor.

While monitoring, the unit differentiates the velocity data into acceleration, applies the frequency weighting and then calculates the **VDV** and **Root Mean Square** (**RMS**) values. The unit displays the **VDV** and **RMS** values every ten seconds while recording, and stores the final calculations as part of the file and Event Report.

The unit is capable of continuously monitoring full waveform data for 24 hours; the daytime **VDV** monitoring is performed on the vertical channel (7:00 AM to 11:00 PM) while the nighttime **VDV** monitoring is performed on the horizontal channels (11:00 PM to 7:00 AM). The **Monitor Scheduler** feature can be used to specify the different settings required for daytime and nighttime monitoring setup files.

NOTE: Due to the processing power and decimal accuracy of a PC, performing **VDV** calculations using the **Blastware** Human Exposure tool on a computer will typically produce a higher accuracy result when compared to the **VDV** recorded in the field by the **Minimate Pro** unit. These results will typically be within 5% of each other.

Tools and Materials Required:

1. **Series IV** Unit
2. **Blastware Advanced Module**
3. **Instantel** 1-80Hz DIN Geophone (Part No. 720A2003)

7.5. GPS [Optional]

Use the **GPS (Global Positioning System) Location** feature to enter location information of the sensor and unit, relative to the blast and have them displayed on your **Event Reports**. GPS devices locate your exact longitude and latitude from orbiting satellites.

Tools and Materials Required:

1. **Series IV** Unit
2. GPS unit must be NMEA 4800 compliant (Instantel supports the **Garmin® eTrex®** handheld GPS unit).

7.6. Series IV Sound Level Microphone [Optional]

The Series IV Sound Level Microphone can perform unattended monitoring of noise, such as building activities, construction, traffic, and mining operations. It is now possible to combine noise and vibration monitoring on the same unit, making the Minimate Pro4™ or Minimate Pro6™ a cost effective and flexible monitor for these applications. The microphone ships with a microphone stand and windscreen.

The Sound Level Microphone was designed to meet the requirements for IEC Class 1, which includes A and C weighted specifications. It has a measuring range from 30 to 140 dB with a fast or slow response. It is also capable of recording the unfiltered response in one of two ranges, +/- 25 Pa or +/- 100 Pa. The record mode can be set to Manual trigger, Waveform (records up to 9000 seconds once a preset trigger level has been exceeded), Histogram (with intervals from 2 seconds to 1 hour) or Histogram-Combo (Compliance mode only, this combines histogram and waveform monitoring at the same time).

In the Blastware® Advanced Mode setup, it can also trigger and record unfiltered sound clips up to 90 seconds long. The resulting data file can then be played back in the Blastware Advanced Mode to help determine the source or it can be further processed, including third octave frequency analysis.

The microphone connects directly to the overpressure channel of the Minimate Pro4 or Minimate Pro6. For additional flexibility, the Minimate Pro6 is capable of monitoring two Sound Level Microphones at the same time using the Blastware Advanced mode. These microphones can be connected directly to the unit or using an extension cable up to 75 meters (250 feet) long.

7.6.1. Installing the Sound Level Microphone

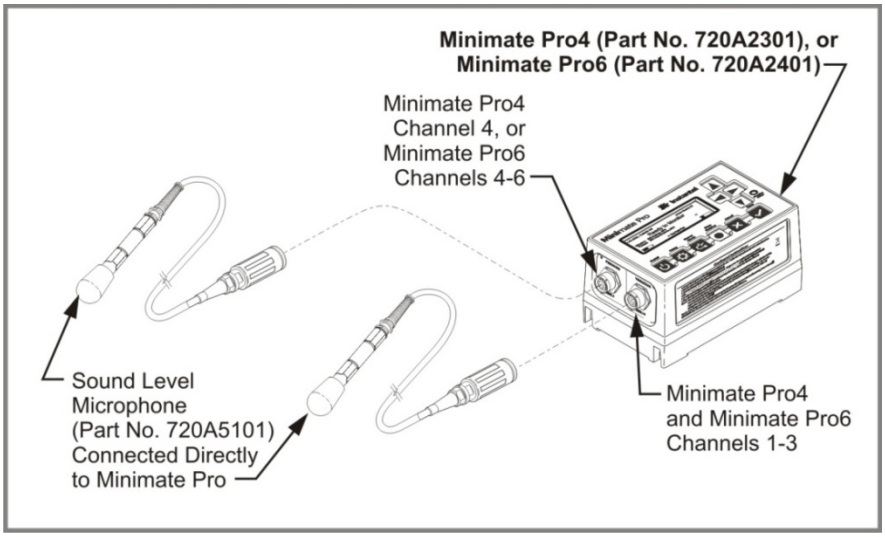
WARNING: Handle the microphone with care. Dropping the microphone or otherwise subjecting it to impact may damage the microphone element. The windscreen can help to protect the microphone, and its use is recommended.

The optional Sound Level Microphone (Part No. 720A5101) is only compatible with the Minimate Pro4 or Minimate Pro6 monitors. It is the Operator's responsibility to ensure that the Sound Level Microphone has been calibrated at an Instantel Authorized Calibration facility, at the Instantel Factory or in the field. Refer to the Maintenance Menu section of this manual for the calibration instructions. Refer to the IEC 61672-1 specification for additional technical descriptions of terms. Section 7.7.7 includes additional information required for the IEC 61672-1 specification.

Follow the steps below to install the microphone in the desired location:

7.6.2. Microphone Installation Procedure

1. Attach the calibrated Class 1 Sound Level Microphone(s) to the Minimate Pro4 or Minimate Pro6, which allows for the use of two microphones, as shown below:



2. Minimate Pro Microphones come with a three-sectional mounting stand. Refer to the instruction sheet that was shipped with the microphone stand for proper installation. Locate the position of interest where you will be inserting the mounting stand for the microphone.

   NOTE: Install the microphone as far from surrounding objects and structures as possible to reduce any possible acoustic reflections; optimally, the microphone and monitor should be placed at a distance closer to the noise source than any surrounding objects including the monitor. Do not place the microphone in direct rain. Use the supplied microphone stand to elevate the microphone off the ground – the microphone should never be held by hand.
3. Insert the microphone into the mounting bracket on the top of the stand, and attach the windscreen to reduce false triggering.
4. Ensure that the element is pointed towards the acoustic event of interest.
5. If in Compliance Mode (where the Setup File name in the upper right corner of the Minimate Pro display ends in ".nsb"), press **Sensor Check** on the Minimate Pro to ensure that the sensor is properly attached.

6. The microphone windscreen does not affect the microphone response and is acoustically transparent.

NOTE: Some microphone windscreens can attenuate the response – it is recommended that this is confirmed prior to using any windscreens other than the one provided with the Sound Level Microphone.

7.6.3. Sound Level Microphone – Unit Compliance Setup

1. The Sound Level Microphone can be configured directly on the Minimate Pro4 or Minimate Pro6 monitor, or in Blastware.
2. If the unit has already been configured for Sound Level Microphones, they will appear on the Channel of the display that corresponds with the connector that the microphone(s) are attached.
3. Once the Compliance setup file has been downloaded into a monitor, it can be edited in the **View/Edit Setup File** menu. Compliance Setup files end with a ".nsb" file extension.
4. On the monitor, press **Setup**.
5. Press the **Down Arrow** and select the **View/Edit Setup File** menu.
6. Scroll down to the **Pressure Channel (**or **Vibration Channel**, dependent on the setup file configuration**)** and press the **Right Arrow** to access the sensor options.
7. Select the **Sound Level Microphone** sensor.
8. Press the **Down Arrow** and locate the **Sound Mic Setup** menu option.
9. Press the **Right Arrow** to enter this menu and edit the **Mic Weighting** and **Mic Response**.
    a. Press the **Right Arrow** to select either **A** or **C Weighting**.
    b. Press the **Down Arrow** to select the **Mic Response** option.
    c. Press the **Right Arrow** to select either **Fast** or **Slow**.
    d. Press **Enter** to accept the new settings or **Cancel** to return to the **Setup** menu.
10. Within the **Setup** menu, ensure that the **Sample Rate**, **Trigger Level** and **Record Times** are also set correctly.
11. Press **Enter** to save any changes made.

NOTE: Refer to the Blastware Operator Manual for information on editing the setup within the software module.

7.6.4. Sound Level Microphone – Unit Advanced Setup

1. Two Sound Level Microphones can only be completely configured in Blastware, including the **Trigger Level**, **Mic Weighting (Unfiltered)**, and **Mic Response**. These must be set in the Blastware Advanced Module and downloaded to the unit as a Setup File. Advanced Setup files end with a ".nsa" file extension. Refer to the Blastware Operator Manual on how to set these variables.
2. If the unit has already been configured for a Sound Level Microphone(s) it will appear on the main display, as follows (if two are connected):
   Vibration 1: Sound, Vert, Long
   Vibration 2: Sound
3. The current setup file is displayed in the top right corner when the unit displays the **Ready to Monitor** message. If this file is not the correct file, press **Setup** and select the **Select Setup File** menu.
4. Press **Down Arrow** until the correct setup file is highlighted.
5. Press **Enter** to open the options window.
6. Press **Enter** to **Select as Current Setup** option. The monitor displays the message that the selected file is now current.
7. Press **Cancel** to exit the **Select Setup File** menu.
8. Press **Cancel** again to return to the **Ready to Monitor** display.

NOTE: The channel name on the Main Display (i.e. Sound) can only be changed using the Blastware program.

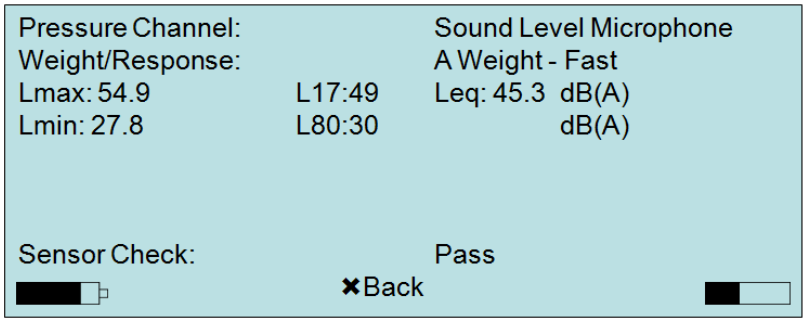
7.6.5. Using the Sound Level Microphone

1. **Sensor Check** is only available in Compliance Mode. Press **Sensor Check** on the **Minimate Pro** to ensure that the sensor is properly attached. A successful **Sensor Check** will return results similar to this;
   MicA **Pass** **Freq= N/A** **Amp=563 mv**

   NOTE: The name of 'MicA' is editable in the Blastware setup.
2. Press **Enter** to continue.
3. Press **Start Monitor** on the unit.
4. If the unit triggers immediately you may need to increase the **Trigger Level**. Review the peak of the previous event, and set the **Trigger Level** at least 3 dB above that value.
5. Press **Start Monitor**.
6. If the unit triggers immediately repeat the previous step otherwise clap your hands in front of the microphone to ensure the unit will trigger.
7. The system will now monitor and record data whenever the **Trigger Level** has been exceeded.

7.6.6. View Compliance Events

1. Once the monitor has recorded at least one event it will display the Lmax level of that event on the display.
2. To view other recorded data on the unit press **Down Arrow** from the main display and highlight the desired event.
3. Press **Right Arrow** three times to display the results of the **Pressure Channel**. The sound data results that will be displayed are the Lmax, Lmin, L90, L10 and Leq values for the entire recording time.



NOTE: Refer to the Blastware Operator Manual for information about how to view, analyze and/or export the recorded data for Compliance and Advanced mode software.

7.6.7. Technical Information for IEC 61672-1 Compliance

1. The Sound Level Microphone is a Group Z, Class 1 instrument.
   a. Group Z refers to an instrument consisting of two separate components that must be connected.
2. Dependent on which Blastware software module that is used, Compliance or Advanced, different data results may be achieved or settings applied, as shown below:

Specifications	Compliance Mode	Advanced Mode (Optional)
Weighting	A-Weight and C-Weight	Unfiltered
Frequency Range	Up to 20 kHz	Up to 20 kHz
Response	Fast 125 ms, Slow 1 s	N/A
Sensitivity	N/A	0.0038 V/Pa (Normal), 0.12 V/Pa (Sensitive)
Resolution	0.05 dB (display limit 0.1dB)	0.03 Pa (Normal), 0.89 mPa (Sensitive)

Range	Automatic	+/- 100 Pa (Normal), +/- 25 Pa (Sensitive)
Trigger Levels	33 dB - 140 dB	0.448 - 100 Pa (Normal), 0.0142 Pa - 25 Pa (Sensitive)
Sample Rate	1024 sps Recommended	64 Ksps Recommended
Cable Length	6 ft. (2 m)	6 ft. (2 m)
Maximum Amplitude	160 dB	160 dB

3. The microphone reference point is at the center of the diaphragm of the microphone.
    a. As the microphone was designed to be omni-directional, there should be minimum angular variation in the microphone response at low frequencies. Sound diffraction on the microphone face only has a significant effect on the response for frequencies above approximately 3.5 KHz. The nominal correction curves, for specific angles, and provided in the following graph. The top curve is for zero degrees, i.e. the microphone face is perpendicular to the plane acoustic wave. The correction is subtracted from the response. Below is a chart representing Sound Level Microphone Angular Response and the Free Field Angular Corrections in Hz:

	1 KHz	4 KHz	6 KHz	8 KHz	10 KHz	15 KHz	20 KHz
0 degrees	0 dB	1.0 dB	2.2 dB	3.5 dB	5.0 dB	8.0 dB	9.5 dB
30 degrees	0 dB	0.5 dB	1.8 dB	3.0 dB	4.2 dB	5.5 dB	7.0 dB
60 degrees	0 dB	0.2 dB	0.8 dB	2.0 dB	3.0 dB	4.0 dB	3.0 dB
90 degrees	0 dB	0 dB	0.2 dB	0.3 dB	0.8 dB	1.3 dB	-0.5 dB
120 degrees	0 dB	0 dB	0 dB	-0.2 dB	-0.2 dB	0 dB	-3.0 dB
150 degrees	0 dB	0 dB	-0.2 dB	-0.3 dB	-0.4 dB	-0.3 dB	-3.5 dB
180 degrees	0 dB	-0.2 dB	-0.4 dB	-0.5 dB	-0.7 dB	-0.8 dB	-4.0 dB

4. The minimum trigger level is set as 33 dB, which is 3 dB above the minimum detectable sound level. This provides a margin against false triggering by self-generated noise.
5. Overload Indicator: Input that is greater than 140 dB is replaced by the "*" character in the data listing. Range switching within the 30 dB to 140 dB range is automatic.
6. Displayed values (including Overload and Under-range indicators) are held until the trigger is exceeded again, or until the end of the subsequent period of recording the Event.
7. The average self-generated noise level has been measured at 29 dB. The noise level of the acoustic element is below this, about 24 dB.
8. The nominal drift of the Time of Day display on the monitor over a 24 hour period is 0.2 seconds.
9. When applied to levels specified by IEC 61000-4-2 (Industrial), ESD has no impact on product operation or accuracy in data.
10. The product meets all (60Hz) immunity requirements of:
    a. IEC 61000-4-6 (Industrial) for conducted RF
    b. IEC 61000-4-5 (Industrial) for surge
    c. IEC 61000-4-4 (Industrial) for bursts
    d. IEC 61000-4-3 (Industrial) for EMI compatibility
11. The level linearity error, over 20 dB (measured at 2 KHz) is +/-0.4 dB.
12. The highest sound pressure that will generate a linear response is 140 dB. Electrically, this corresponds to a 12 Vpp signal from the acoustic element.
13. When the Sound Level Microphone is operating in Advanced Mode (i.e. when raw acoustic data is input to the monitor), the response matches the response of the acoustic element (within 3 dB) over the frequency range 10Hz – 20 KHz.
14. Factory calibration testing is done at both the A-Weighting and C-Weighting, to ensure linearity of response during automatic range switching,

15. The worst-case environmental change would be from -40 C (-40 F) – +50 C (122 F), or vice versa. This is a 90 C (32 F) change. Recommended time to acclimatize the microphone to this temperature range is 2 hours.
16. There is no correlation between electromagnetic emissions and operation of the Sound Level Microphone, in any mode.
17. For the Sound Level Microphone, the least immunity to EMI would occur at the lowest input signal level, at any frequency, since the imposed electrical signals would be large compared to any desired input signal. To minimize induced noise, the cable between the microphone and the Monitor Unit should be parallel to any electrical field.
18. The Minimate Pro4 and Minimate Pro6 monitors use rechargeable lithium-Ion batteries. These batteries are not serviceable unless returned to the factory or to an authorized Instantel Calibration Site. There is no internal access to the batteries that provides for user maintenance without disassembly of the monitor and breach of warranty.
    a. Nominal battery life after full charge is 10 days.
    b. The AC charger supplied with the monitoring system is12V 1A. The current limit is confirmed by design analysis and product tests.
    c. The range of DC output voltages from the AC adapter for which correct operation is guaranteed is 8V – 16V.
    d. Sound Level Microphone may be operated indefinitely if plugged into an AC source as part of the monitoring system. However, the AC power supply is specified for operation in protected environments only. For extended operation outside, the AC charger may be replaced by a solar cell (supplied by the customer) or marine battery.
    e. There are no customer-accessible electrical outputs in the system.
    f. The only component of the product that must be operated in an environmentally controlled enclosure is the AC adapter for charging the batteries.

Notes:

8. BASIC TUTORIAL

In this basic tutorial, you will set up your computer and the supplied **Instantel® Blastware** program to work together with the **Instantel® Minimate Pro™**. You will then create a sample Event using the **Manual Record Mode**, and transfer the Event file from your **Minimate Pro** to the computer. Once you have completed this, you view and print the **Event Summary Report**.

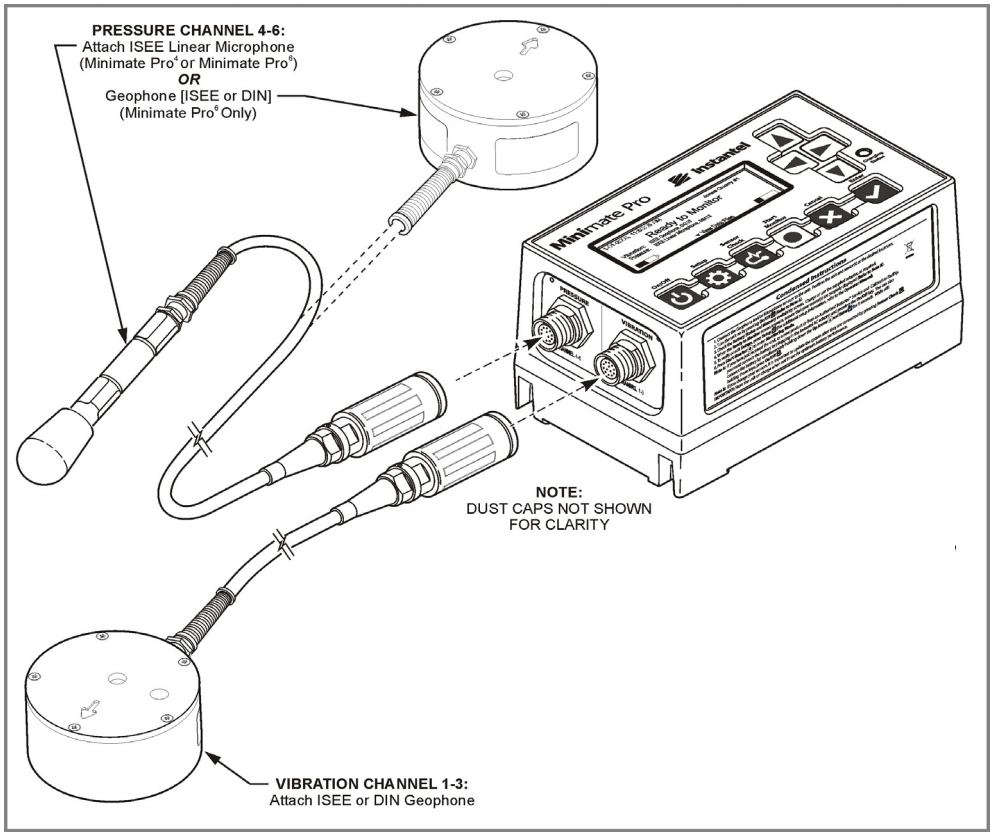
Step 1: Install the Blastware Software

1. A copy of the **Blastware** program was shipped with the unit that was purchased; this will either be the **Blastware Compliance Module**, which is provided with every delivered unit, or the optional **Blastware Advanced Module**. A custom-programmed USB hardware device lock is shipped with the **Advanced Module** which allows access to additional tools and processes.
2. Follow the installation instructions within the **Blastware Operator Manual**.

Step 2: Connect the Geophone and Microphone to the Unit

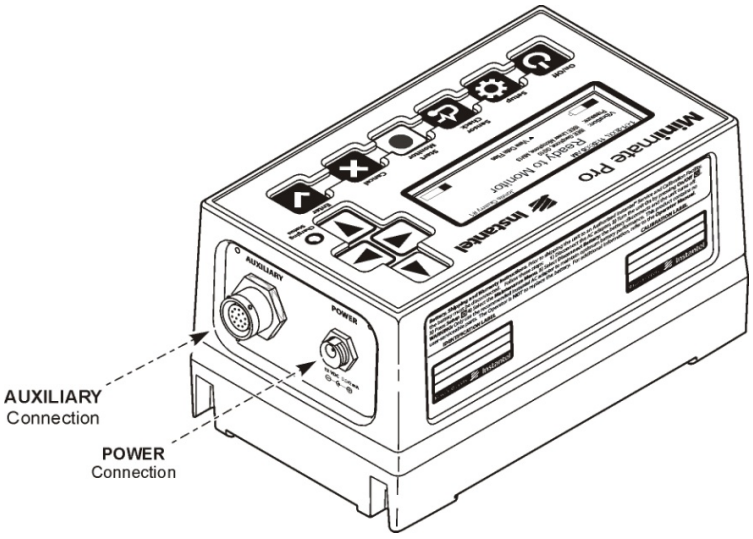
1. Align and connect the ISEE or DIN Geophone(s) and/or the Linear Microphone to the connections with the proper labels on the **Minimate Pro**. Firmly hand-tighten each cable connector with a quarter turn of the cable connectors. For unit identification, the top label on the unit indicates if you have a **Minimate Pro4**, or **Minimate Pro6**.

    a. Connect the Geophone to the channel connector labeled **VIBRATION** (Blue) if you have a **Minimate Pro4**, or one Geophone to the **VIBRATION** (Red) and one Geophone to the **PRESSURE** (Red/Blue) channel connectors if you have a **Minimate Pro6**. Connect the Linear Microphone to the channel connector labeled **PRESSURE**.



Step 3: Connect the Unit to the Computer and Power Supply

1. Follow the manufacturer's instructions for installing the USB drivers for the Serial to USB adaptor device. Connect the **Minimate Pro** to your computer using the supplied RS232 connecting cable and the USB to Serial adaptor – Secure the other end of the cable to the connector labeled **AUXILIARY** located on the right hand side of the **Minimate Pro**.

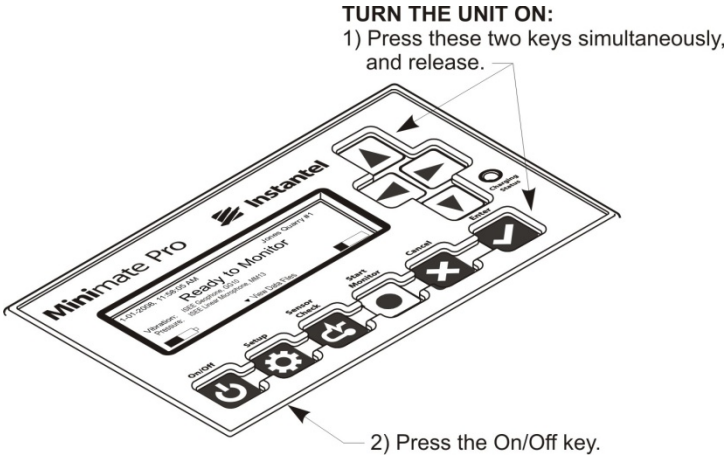


2. Connect the power supply to the unit and plug it into a wall receptacle. The figure above indicates the position of these connectors.

NOTE: If you have purchased the optional **Ethernet® Communications Cable** (Part No. 720A4101), please refer to that section of this manual for setup instructions, otherwise this tutorial assumes that you are using the supplied serial communications cable and USB adaptor.

Step 4: Turn the Unit On

If you have received your **Minimate Pro** directly from an **Instantel Dealer**, or from an Authorized **Instantel** Service and Calibration Facility, the battery will be deactivated for shipping safety and battery life conservation. Turn the battery on for charging by plugging in the AC Adapter to the unit and an electrical outlet, and pressing the **On/Off** key. If you do not have the AC Adapter, turn on the unit by pressing the **Up Arrow** and **Enter** keys simultaneously for approximately three seconds, and then press the **On/Off** key while still holding the other two keys. The unit will flash on with the introductory screen, and then display the main screen.



NOTE: A **Charging Status** LED is mounted next to the **Down Arrow** key and indicates the following:

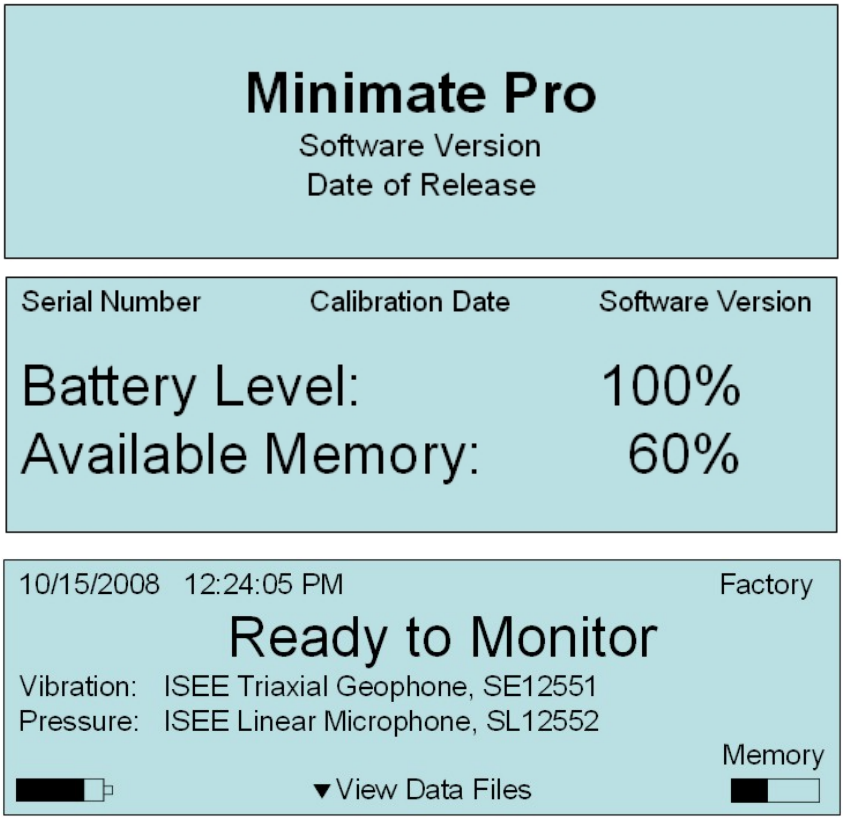
a. **The light is not on -** the charger is not connected to a power outlet, or the charger is not functioning properly.

b. **The light is Yellow -** the charger is connected to a power outlet and is charging.

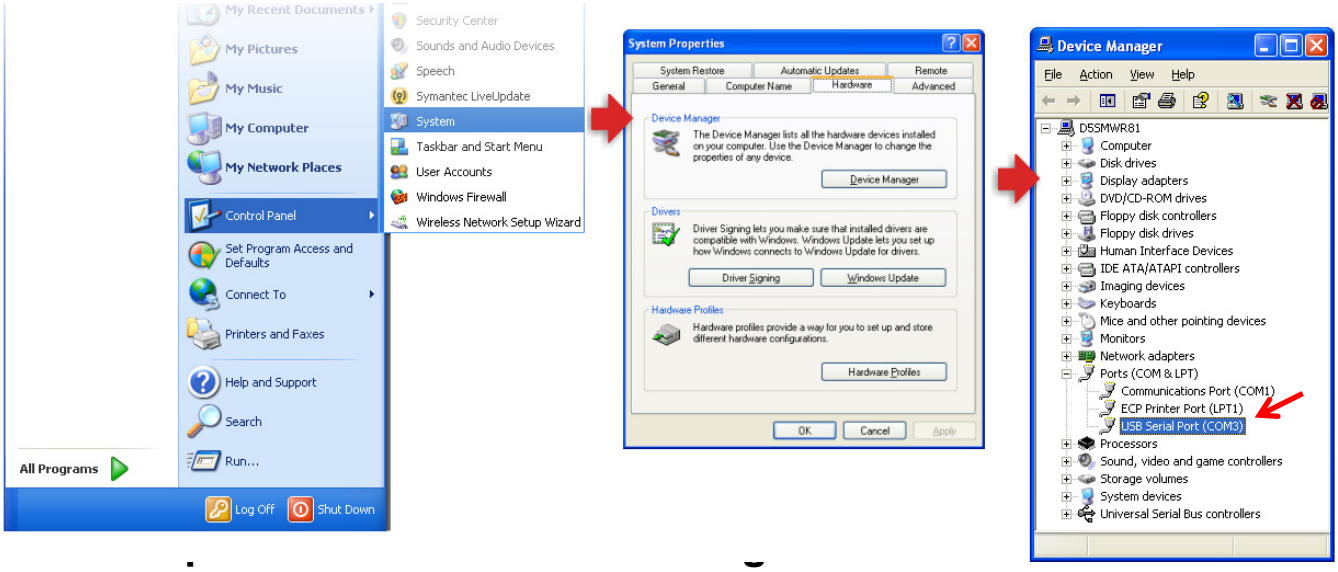
c. **The light is Green -** the batteries are fully charged.

d. **The light is flashing Red/Yellow –** the power source is not sufficient (i.e. battery, solar panel, or malfunctioning charger).

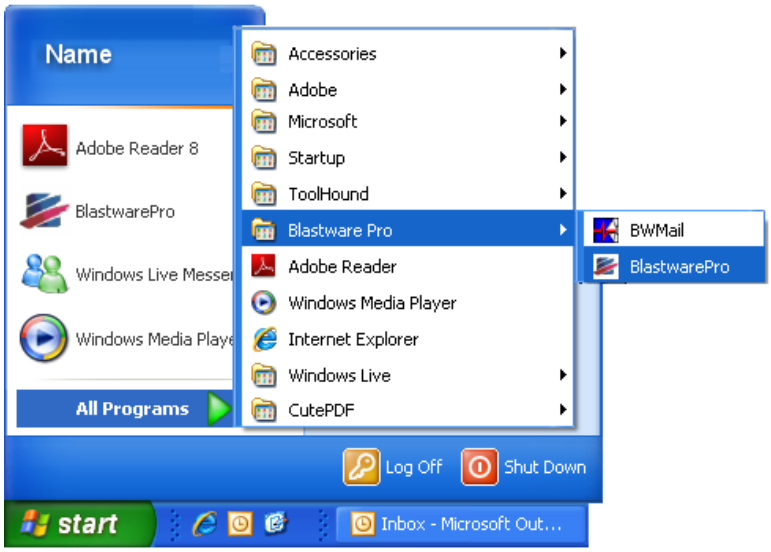
1. After the introductory, battery and memory screens display, the main display screen will appear showing that the Geophone and Linear Microphone, if attached, (or additional Geophone, if you have purchased the **Minimate Pro6**) have been recognized during the initial **Sensor Check**. The Serial Number (e.g. SE12551) follows after each sensor type.



2. Determine the **COM Port** number that your Windows® software automatically assigns to the unit. Do this by using the **USB Serial Communication Connector**, by selecting **Start –> Control Panel –> Device Manager**. Scroll down and click on the ⊞ icon next to **Ports (COM * LPT)**. In the example below, it is **COM3** – write this number down as it will be used in a later *Step 6* to help determine the communication settings.

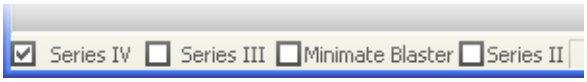


1. Click on the Windows Start button in the lower left of the screen, select **Programs**, and then click on the icon for the previously installed **Blastware** program.



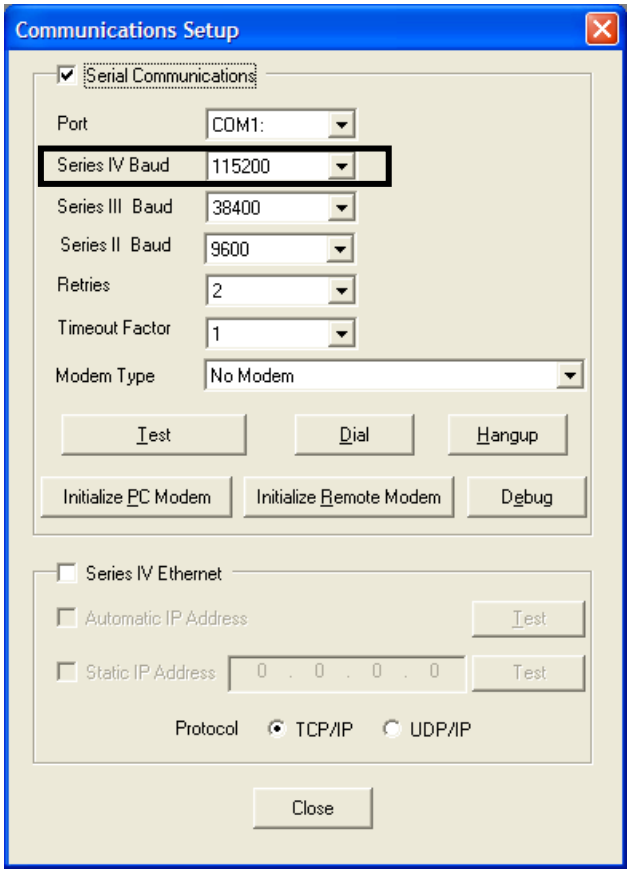
Step 6: Setup Communications

1. Ensure that the check box for **Series IV** is selected at the lower left of the **Blastware** software window, as follows:



2. This tutorial assumes that you are using the supplied serial communications cable with the USB adaptor. If you have purchased the optional **Ethernet®** communication cable, proceed to that section of the manual for instructions on communications between **Blastware** and the unit using the **Ethernet** communication protocol.

3. Communication with a **Minimate Pro** and your computer is configured using the **Communications Setup** dialog box located under the **Unit** menu. Open the **Unit** menu and choose **Communications**. The **Communications Setup** dialog box appears, as shown below:



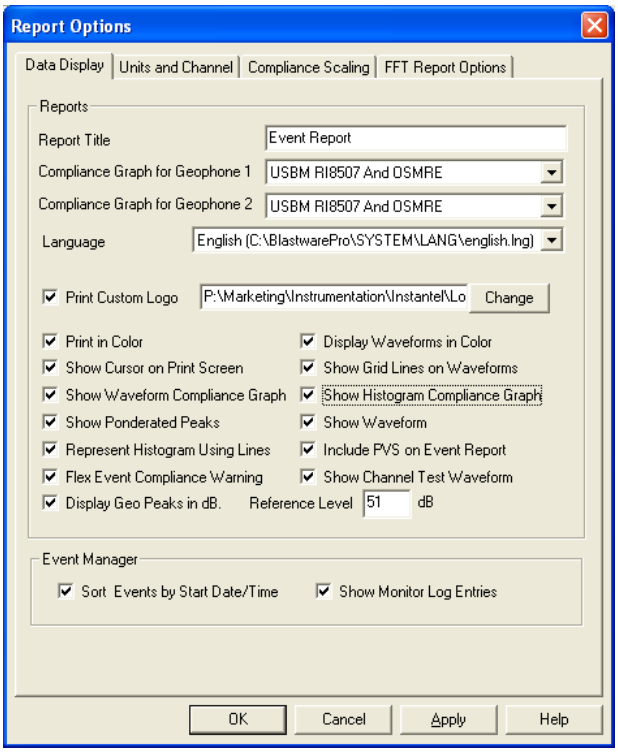
If required, we will only adjust the **Port** dropdown menu. The other menus, **Baud Rate**, **Retries**, and **Modem Type** should have the same settings as the dialog box pictured above. Ensure that the baud rate on the unit is also set to **115200** by following these steps:

1. Press the **Setup** key.
2. Press the **Down Arrow** key until **View/Edit Preferences** is highlighted. Press the **Enter** key.
3. Press the **Down Arrow** key until **Serial Baud Rate** is highlighted.
4. If the value to the right of **Serial Baud Rate** is not **115200**, then press the **Right Arrow** key to edit this value to match the **Series IV Baud** rate shown in the image above.
5. Press the **Enter** key to accept the changes.
6. Press the **Cancel** key to exit the setup menu and return to the main display on the unit.

Step 7: Define the Contents of the Event Summary Report

Blastware creates an **Event Summary Report** for each recorded Event. **Blastware** offers you a wide degree of flexibility to define the contents and visual aspects of these reports. In this step, we enter a new report title, choose a **Compliance Report Graph**, and measurement units.

1. Open the **Report Options** Menu by clicking on the icon, or access it from the **File** Menu.



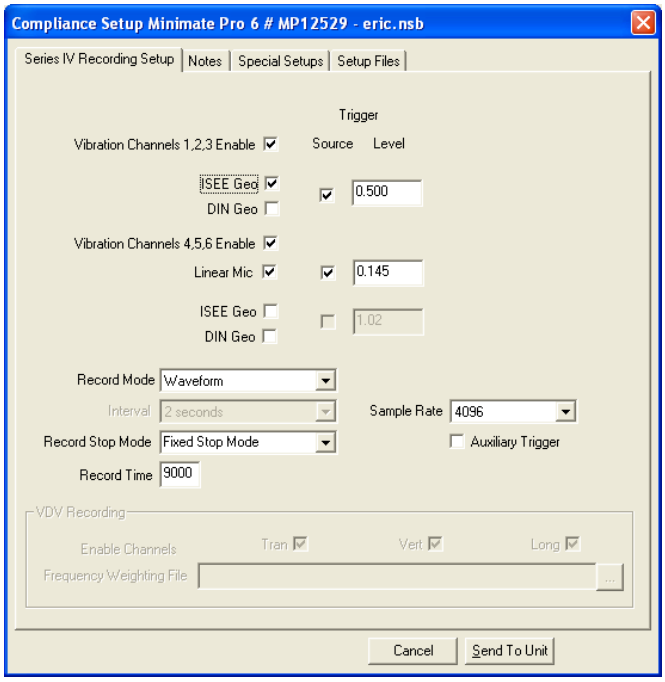
2. Change the **Report Title**.
   You can change the **Report Title** to a title of your choice. Position the mouse pointer in the **Report Title** text box. Press the **Backspace** key to delete the existing title. **Enter** a new title up to a maximum of forty nine characters.
3. Choose a **Compliance Report Graph**.
   Blastware supports numerous compliance report graphs. For **Minimate Pro4** and **Minimate Pro6** units, choose a **Compliance Report Graph** by positioning the mouse pointer over the **Compliance Graph for Geophone 1** dropdown menu and click the left mouse button. A list of supported **Compliance Reports** appears. Scroll through the list and choose a report by clicking the left mouse button. If you have a **Minimate Pro6** and have a second geophone attached to the monitor, you can select an associated graph by using the dropdown menu for **Compliance Graph for Geophone 2**.
4. All other **Report Options** are covered in more depth within the **Blastware Operator** manual.
5. Press the **OK** button to close the dialog box and save your changes.

Step 8: Use Blastware to Create or Edit a Setup File

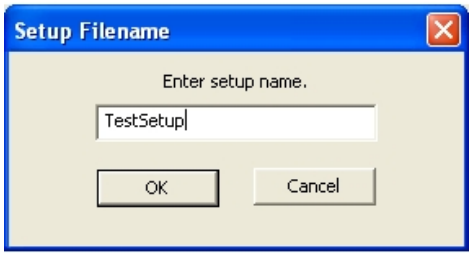
Use **Blastware** to create a new **Compliance Setup**.

1. Select **Unit** menu, and click on **Setup**, and then **Compliance Setup**, or click on the **Compliance Setup** icon. At the bottom of the Compliance Setup, you will notice that the **VDV (Vibration Dose Value) Recording** option may not be available. If this is the case, you must order the optional **Blastware Advanced Module** software to gain access to this feature.

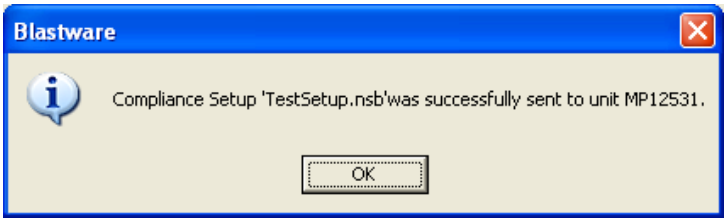
2. Modify the available settings as per your requirements and the sensors attached to the unit, then click on the **Send to Unit** button. Below is an example of the settings:



3. The software will open the **Setup Filename** dialog. **Enter** a setup name in the text box and click on **OK**.



4. After the **Setup Filename** has successfully been sent to the unit, the following message will appear:

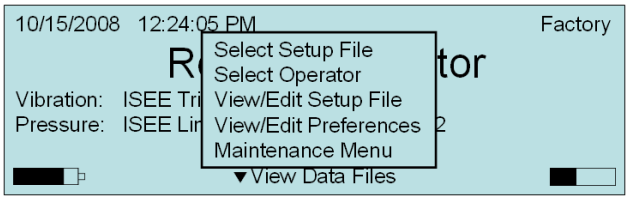


Select **OK** to return to the Compliance **Setup** dialog.

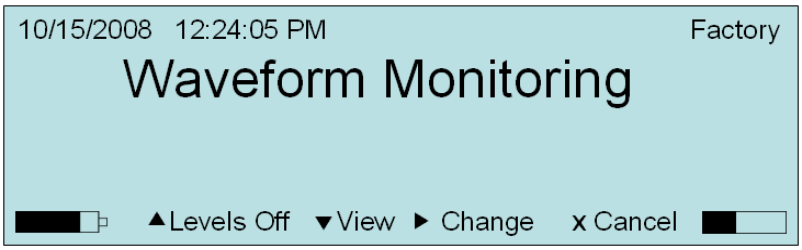
Step 9: Creating a Sample Event

Refer to *Section 6.5*, **Unit Keypad** and **Menu Navigation Overview**, to become familiar with the menus of the **Minimate Pro** prior to proceeding with this step.

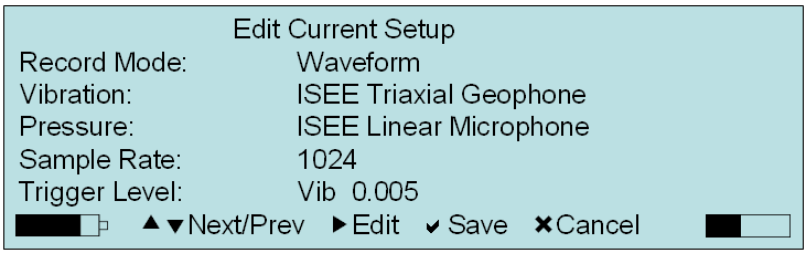
1. Press the **Setup** key. The **Main Menu** appears, as follows:



2. Press the **Down Arrow** key until the **View/Edit Setup File** menu item is highlighted. Press the **Enter** key to access this menu.



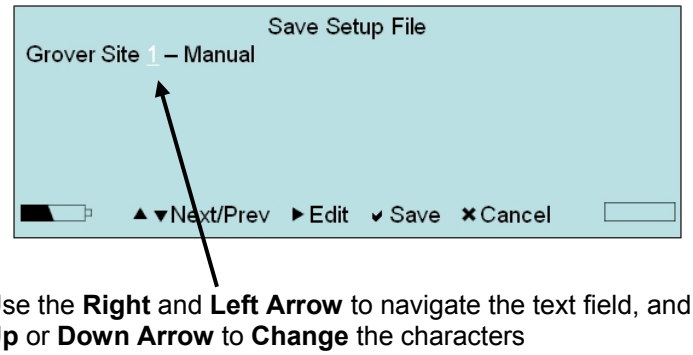
3. Highlight the **Record Mode** menu option and press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Waveform Record Mode** option appears.



4. Press the **Enter** key to **Save** these settings. A **Save Setup to File** menu appears.

   TIP: Use the **Save Setup File** name as a way to identify a location or particular settings used to record the **Event**s for easier identification.

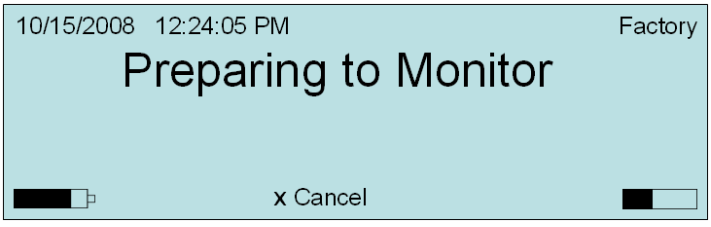
5. Press the **Right** and **Left Arrow** keys to navigate the text field, and the **Up** or **Down Arrow** keys to **Change** the characters. Upper and lowercase alphabet characters are provided, as well as numerals 0 – 9, "-", and a space.

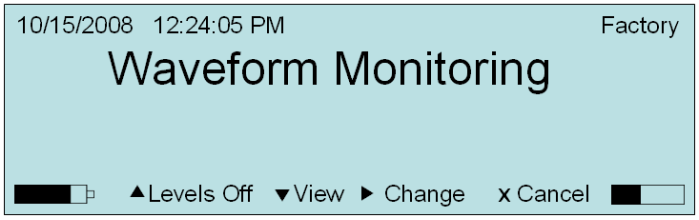

Save Setup File
Grover Site 1 – Manual
▲▼Next/Prev
▶Edit
✔ Save
✖Cancel
Use the Right and Left Arrow to navigate the text field, and the
Up or Down Arrow to Change the characters

6. Once the **Setup File** name has been created, press the **Save** key. Press **Save** again to exit the **Setup Menu**, and **Cancel** again to get to the **Main Display**.

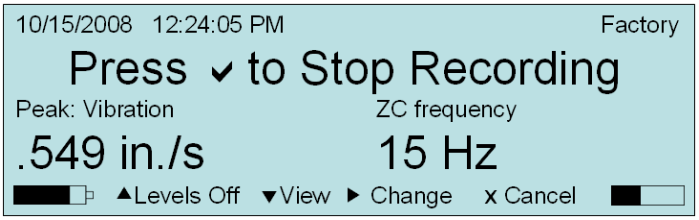
7. You are now **Ready to Monitor** by pressing the **Start Monitor** key on the unit. The unit will briefly display **Preparing to Monitor**.

8. The unit then displays the following messages:

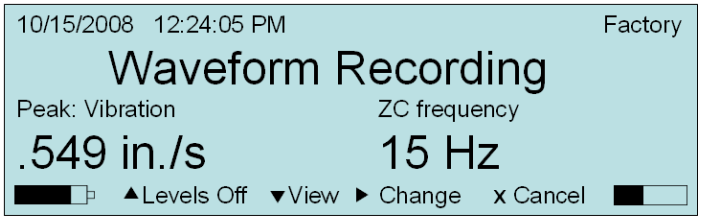


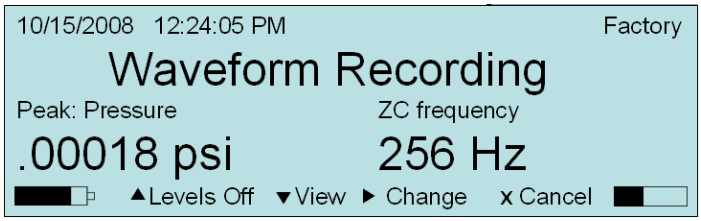


9. Lightly tap the surface next to the geophone, or gently on the geophone itself – the **Peak Vibration** results and **Zero Crossing (ZC) Frequency** of the recorded Event appear on the display:



10. Press the **Right Arrow** to **Change** between **Peak Vibration** and **Peak Overpressure** results. There is a 1/3 second delay between an Event ending and the level data being displayed. If an Event is triggered during that delay the display is not updated. Below is an example of the two **Peak** and **ZC Frequency** readouts that are dynamically displayed:

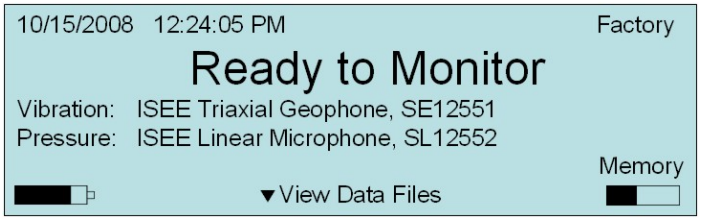




11. Press the **Cancel** key to stop recording, and the screen will return to **Main Display**. At any time, during, before or after, you can push the **Down Arrow** key to turn **Levels Off** and the display will no longer be updated with the **Peak** and **ZC Frequency** information.

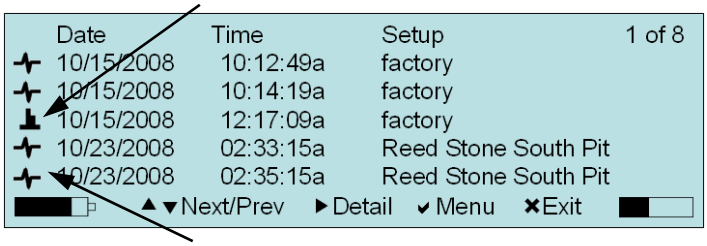
Step 10: View Data File Information on the Unit

1. From the main menu, select the **Down Arrow** key on the unit to access **View Data Files**. The **View Data Files** command is also accessible while recording.



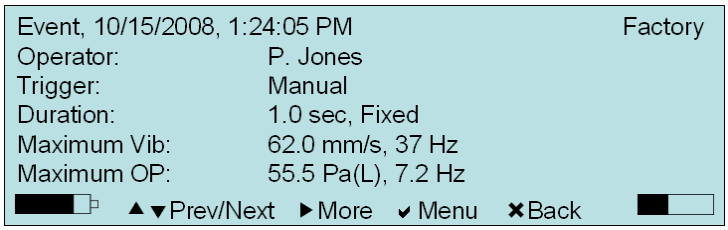
2. A list of recorded Events will appear. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev** Events. Press and hold the **Down** or **Up Arrow** key to quickly scroll. **Waveform** or **Histogram** Events have a different icon displayed:

SYMBOL REPRESENTING A RECORDED HISTOGRAM EVENT

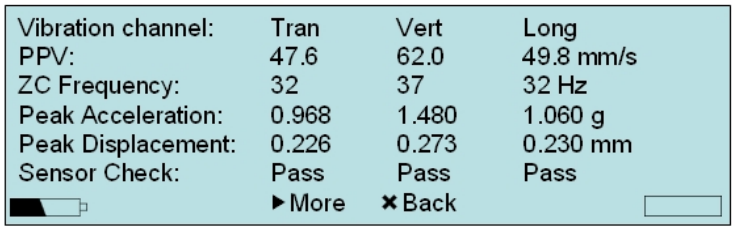

Date Time Setup 1 of 8
10/15/2008 10:12:49a factory
10/15/2008 10:14:19a factory
10/15/2008 12:17:09a factory
10/23/2008 02:33:15a Reed Stone South Pit
10/23/2008 02:35:15a Reed Stone South Pit
▲▼Next/Prev ▶Detail ✔Menu ✖Exit

SYMBOL REPRESENTING A RECORDED WAVEFORM EVENT

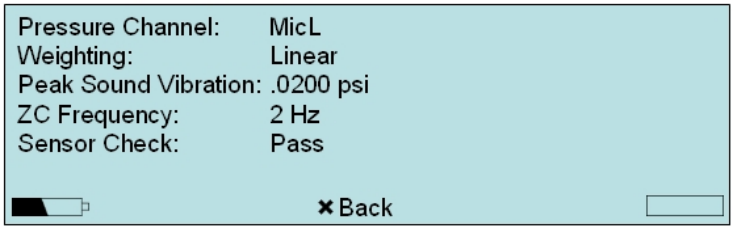
a. Press the **Right Arrow** key to display the **Detail** of an Event. Below is an example of the **Detail** feature for a ***Waveform Manual Event***:


Event, 10/15/2008, 1:24:05 PM Factory
Operator: P. Jones
Trigger: Manual
Duration: 1.0 sec, Fixed
Maximum Vib: 62.0 mm/s, 37 Hz
Maximum OP: 55.5 Pa(L), 7.2 Hz
▲▼Prev/Next ▶More ✔Menu ✖Back

i. Press the **Right Arrow** key to review **More** data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:


Vibration channel: Tran Vert Long
PPV: 47.6 62.0 49.8 mm/s
ZC Frequency: 32 37 32 Hz
Peak Acceleration: 0.968 1.480 1.060 g
Peak Displacement: 0.226 0.273 0.230 mm
Sensor Check: Pass Pass Pass
▶More ✖Back

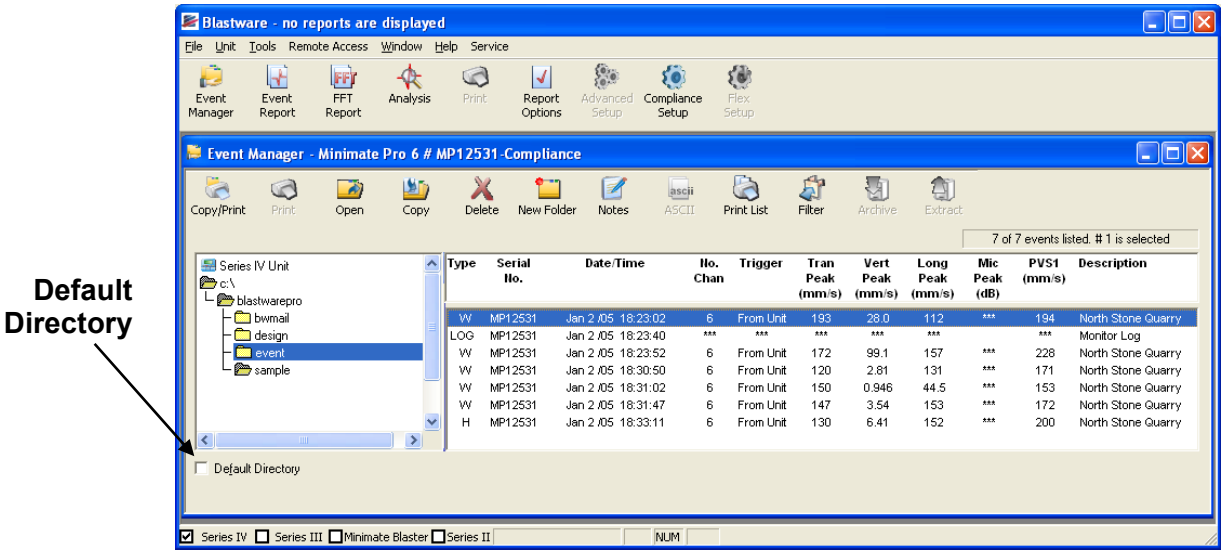
ii. Press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:



Step 11: Open the Event Manager

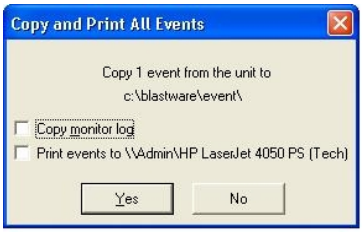
The **Event Manager** organizes the Event files stored on your computer similar to the Windows File Manager. The Event Manager allows you to **Copy**, **Delete**, **Print**, and **View** Events by simply selecting an Event and pressing the appropriate command icon. If the **Event Manager** is not open, click the mouse pointer on the **File Menu** then click on the **Event Manager** command.

The **Event Manager** dialog box appears. Ensure that you are in the proper directory, c:**Blastware**\Event, and set this as the default by selecting the box next to **Default Directory**, shown in the lower left hand of **Blastware**.

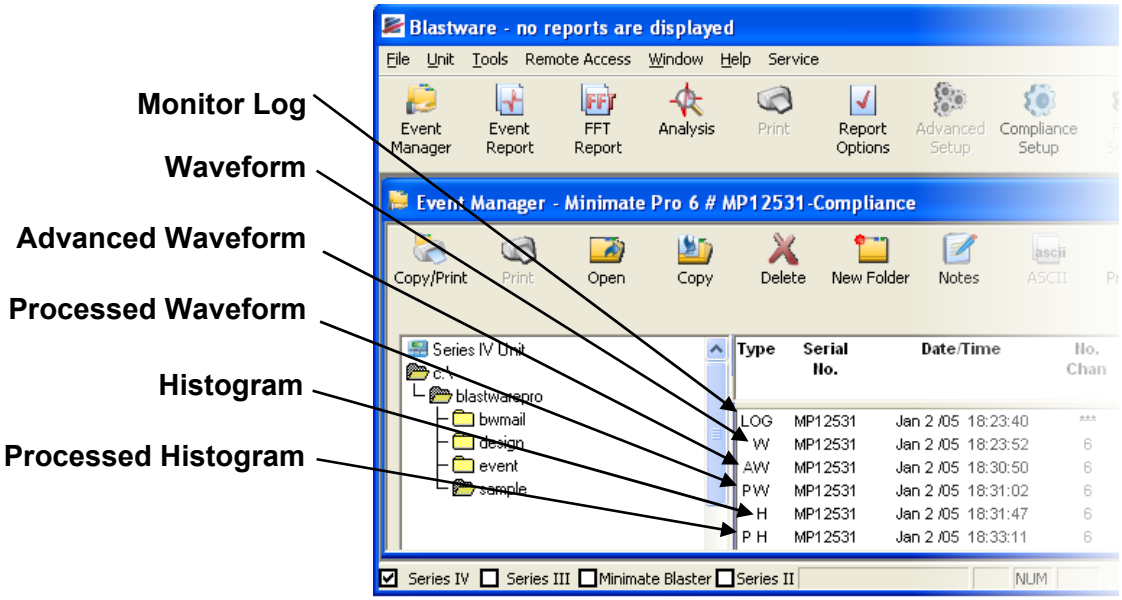

Default Directory
Blastware - no reports are displayed
File Unit Tools Remote Access Window Help Service
Event Manager
Event Report
FFT Report
Analysis
Print
Report Options
Advanced Setup
Compliance Setup
Flex Setup
Event Manager - Minimate Pro 6 # MP12531-Compliance
Copy/Print
Print
Open
Copy
Delete
New Folder
Notes
ASCII
Print List
Filter
Archive
Extract
7 of 7 events listed. # 1 is selected
Series IV Unit
c:\
blastwarepro
bwmail
design
event
sample
Type Serial No. Date/Time No. Chan Trigger Tran Peak (mm/s) Vert Peak (mm/s) Long Peak (mm/s) Mic Peak (dB) PVS1 (mm/s) Description
W MP12531 Jan 2 /05 18:23:02 6 From Unit 193 28.0 112 *** 194 North Stone Quarry
LOG MP12531 Jan 2 /05 18:23:40 *** *** *** *** *** *** Monitor Log
W MP12531 Jan 2 /05 18:23:52 6 From Unit 172 99.1 157 *** 228 North Stone Quarry
W MP12531 Jan 2 /05 18:30:50 6 From Unit 120 2.81 131 *** 171 North Stone Quarry
W MP12531 Jan 2 /05 18:31:02 6 From Unit 150 0.946 44.5 *** 153 North Stone Quarry
W MP12531 Jan 2 /05 18:31:47 6 From Unit 147 3.54 153 *** 172 North Stone Quarry
H MP12531 Jan 2 /05 18:33:11 6 From Unit 130 6.41 152 *** 200 North Stone Quarry
Default Directory
Series IV
Series III
Minimate Blaster
Series II
NUM

Step 12: Copy All the Events to Your Computer

1. Copy Events from the **Minimate Pro** to your computer, by pressing the **Copy/Print** icon. The **Copy and Print All Events** dialog box appears. Press the **Yes** button to copy all the Events on the unit, and display them in the **Events List Box**. Click on the **Print** checkbox to print the Events on your computers default printer at the same time.

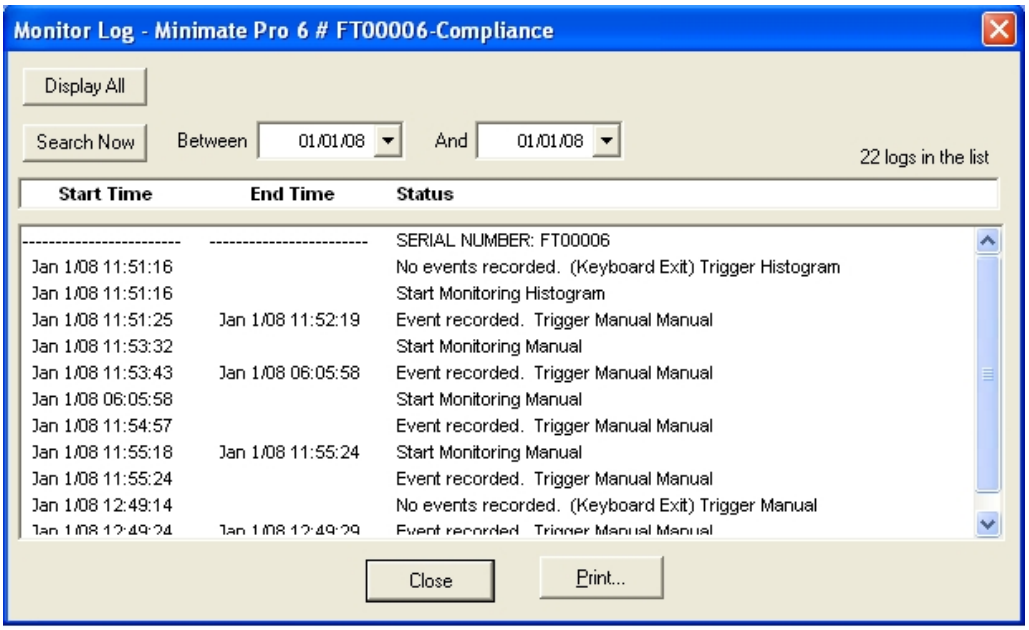


2. The Events will be automatically copied to your current version of the **Blastware** Event folder. When different types of recorded **Event**s are transferred to the **Blastware** Event Manager, each one is given a specific character to denote the **Type** of file it is, as indicated below:



NOTE: Different recording selections (i.e. **Waveform** or **Histogram**) will produce a filename with a different **Type** noted. In the picture above, two Events have a "**P**" as part of their designation – this indicates that the Event was copied and subsequently 'Processed' by using the Tools and/or Process features of the **Blastware Advanced Module** software.

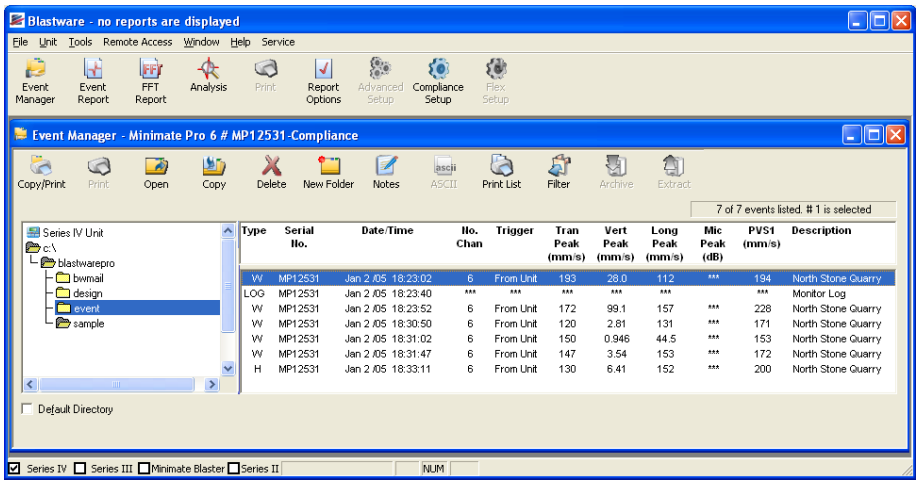
NOTE: The **LOG** file type is a history of the monitoring activity; double-clicking on this file type will display a **Monitoring Log**. The results for the **Self Check** feature will also appear here if you have turned it on – please refer to the **Self Check** section of this manual for more information on this diagnostic tool. An example **Monitor Log** is shown below:


Monitor Log - Minimate Pro 6 # FT00006-Compliance
Display All
Search Now
Between 01/01/08
And 01/01/08
22 logs in the list
Start Time
End Time
Status
SERIAL NUMBER: FT00006
Jan 1/08 11:51:16 No events recorded. (Keyboard Exit) Trigger Histogram
Jan 1/08 11:51:16 Start Monitoring Histogram
Jan 1/08 11:51:25 Jan 1/08 11:52:19 Event recorded. Trigger Manual Manual
Jan 1/08 11:53:32 Start Monitoring Manual
Jan 1/08 11:53:43 Jan 1/08 06:05:58 Event recorded. Trigger Manual Manual
Jan 1/08 06:05:58 Start Monitoring Manual
Jan 1/08 11:54:57 Event recorded. Trigger Manual Manual
Jan 1/08 11:55:18 Jan 1/08 11:55:24 Start Monitoring Manual
Jan 1/08 11:55:24 Event recorded. Trigger Manual Manual
Jan 1/08 12:49:14 No events recorded. (Keyboard Exit) Trigger Manual
Close
Print...

Step 13: View an Event Report

You can view an **Event** or **FFT** Report by selecting an Event and clicking on the **Event Report** or **FFT Report** icons provided in the toolbar. These reports can also be accessed by pre-selecting them under the **Window** menu, using **Auto Open –** select the reports you would like to view automatically by highlighting them with a check mark. The default is all reports. To

automatically view reports using the **Auto Open** selections, highlight an Event and then double click your left mouse button on the desired Event, and the reports will be created in a new window based on the settings you have defined within the **File** menu, **Report Options** dialog.


Blastware - no reports are displayed
File Unit Tools Remote Access Window Help Service
Event Manager
Event Report
FFT Report
Analysis
Print
Report Options
Advanced Setup
Compliance Setup
Flex Setup
Event Manager - Minimate Pro 6 # MP12531-Compliance
Copy/Print
Print
Open
Copy
Delete
New Folder
Notes
ASCII
Print List
Filter
Archive
Extract
7 of 7 events listed. # 1 is selected
Series IV Unit
c:\
blastwarepro
bwmail
design
event
sample
Type Serial No. Date/Time No. Chan Trigger Tran Peak (mm/s) Vert Peak (mm/s) Long Peak (mm/s) Mic Peak (dB) PVS1 (mm/s) Description
W MP12531 Jan 2 /05 18:23:02 6 From Unit 193 28.0 112 *** 194 North Stone Quarry
LOG MP12531 Jan 2 /05 18:23:40 *** *** *** *** *** *** Monitor Log
W MP12531 Jan 2 /05 18:23:52 6 From Unit 172 99.1 157 *** 228 North Stone Quarry
W MP12531 Jan 2 /05 18:30:50 6 From Unit 120 2.81 131 *** 171 North Stone Quarry
W MP12531 Jan 2 /05 18:31:02 6 From Unit 150 0.946 44.5 *** 153 North Stone Quarry
W MP12531 Jan 2 /05 18:31:47 6 From Unit 147 3.54 153 *** 172 North Stone Quarry
H MP12531 Jan 2 /05 18:33:11 6 From Unit 130 6.41 152 *** 200 North Stone Quarry
Default Directory
Series IV Series III Minimate Blaster Series II
NUM

1. The settings of your PC monitor (i.e. 800 x 600) will determine the extent of the **Event Report** you will be able to view without scrolling.
   Scroll through the Event.

   Click on the **scroll bars (Arrows)** to scroll through the **Event Report**.

2. **View the Entire Event.**

   Click on the **File** Menu and choose the **Print Preview** command. The entire **Event Report** appears on your display.

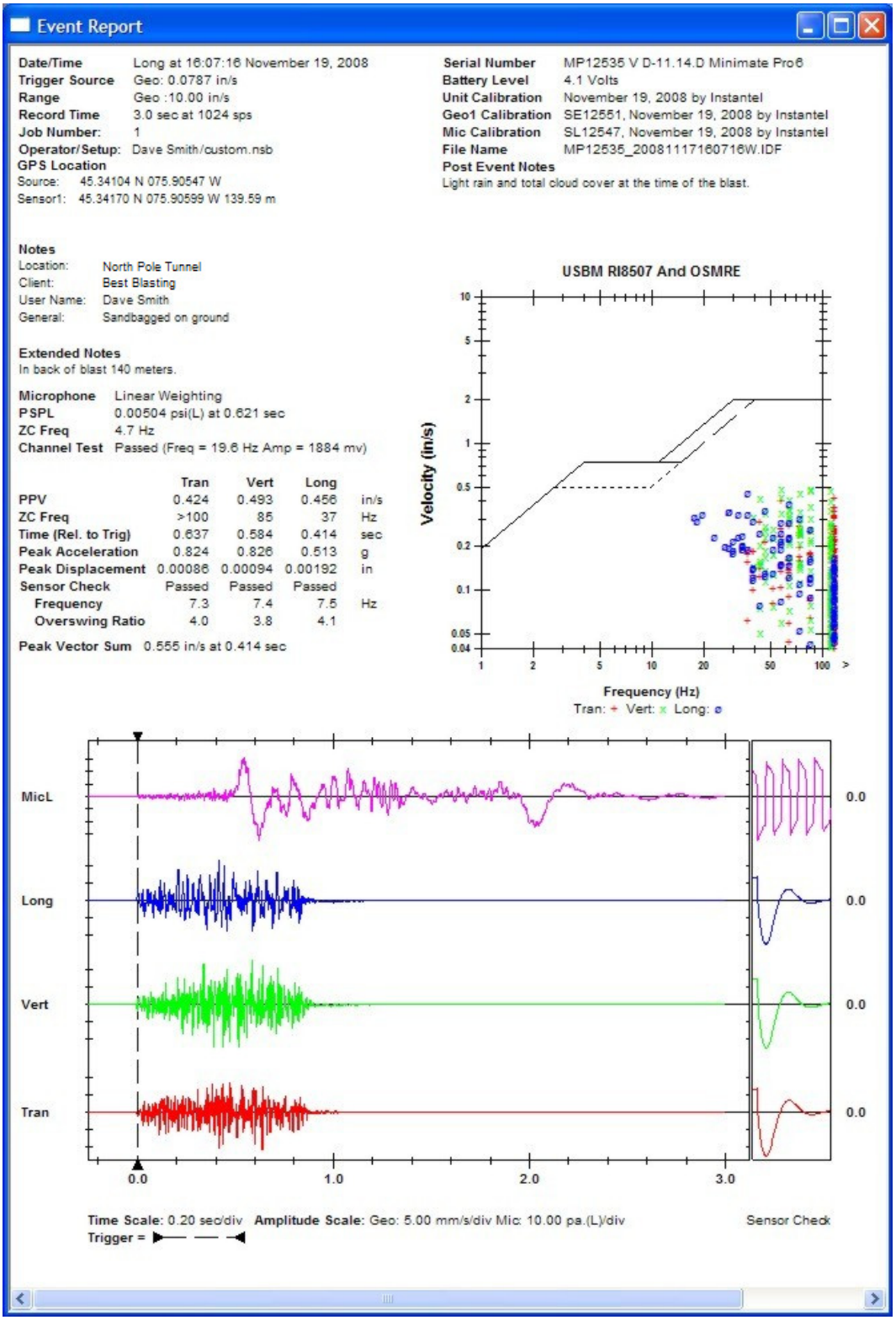
3. **Add Post Event Notes.**

   Click on the **Tools Menu** and click on the **Post Event Notes** command. **Enter** your comments and press the **Apply to Event** button.

4. **Print the Event.**

   To print an Event, click on **File** Menu and click on the **Print** command, or use the **Print** icon available in the toolbar. If required, adjust the settings in the Printer dialog box and press **OK** or **Yes** to send the print job to your local default printer.

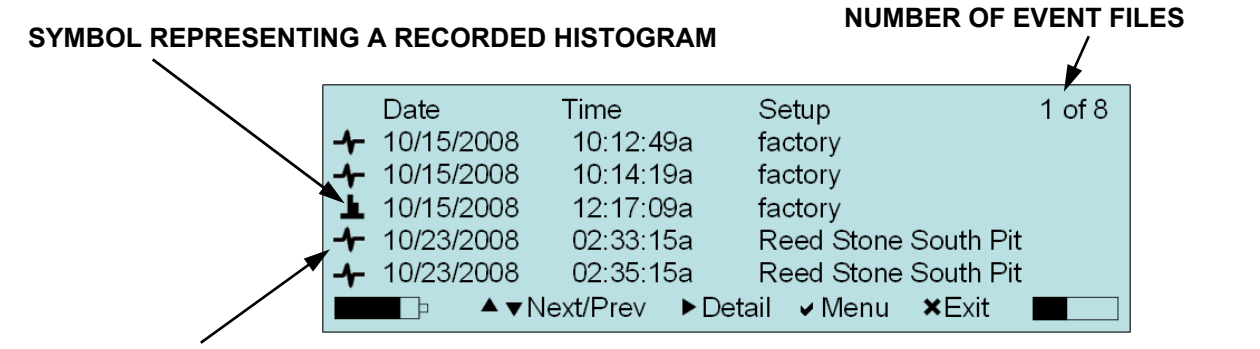
Below is an example of a **Series IV Event Report** using the **Waveform Record Mode**:


Event Report
Date/Time Long at 16:07:16 November 19, 2008
Trigger Source Geo: 0.0787 in/s
Range Geo :10.00 in/s
Record Time 3.0 sec at 1024 sps
Job Number: 1
Operator/Setup: Dave Smith/custom.nsb
GPS Location
Source: 45.34104 N 075.90547 W
Sensor1: 45.34170 N 075.90599 W 139.59 m
Serial Number MP12535 V D-11.14.D Minimate Pro6
Battery Level 4.1 Volts
Unit Calibration November 19, 2008 by Instantel
Geo1 Calibration SE12551, November 19, 2008 by Instantel
Mic Calibration SL12547, November 19, 2008 by Instantel
File Name MP12535_20081117160716W.IDF
Post Event Notes
Light rain and total cloud cover at the time of the blast.
Notes
Location: North Pole Tunnel
Client: Best Blasting
User Name: Dave Smith
General: Sandbagged on ground
Extended Notes
In back of blast 140 meters.
Microphone Linear Weighting
PSPL 0.00504 psi(L) at 0.621 sec
ZC Freq 4.7 Hz
Channel Test Passed (Freq = 19.6 Hz Amp = 1884 mv)
Tran Vert Long
PPV 0.424 0.493 0.456 in/s
ZC Freq >100 85 37 Hz
Time (Rel. to Trig) 0.637 0.584 0.414 sec
Peak Acceleration 0.824 0.826 0.513 g
Peak Displacement 0.00086 0.00094 0.00192 in
Sensor Check Passed Passed Passed
Frequency 7.3 7.4 7.5 Hz
Overswing Ratio 4.0 3.8 4.1
Peak Vector Sum 0.555 in/s at 0.414 sec
USBM RI8507 And OSMRE
Velocity (in/s)
Frequency (Hz)
Tran: + Vert: x Long: ø
MicL
Long
Vert
Tran
0.0
1.0
2.0
3.0
Time Scale: 0.20 sec/div Amplitude Scale: Geo: 5.00 mm/s/div Mic: 10.00 pa.(L)/div
Sensor Check
Trigger =

9. UNIT MENU OVERVIEW

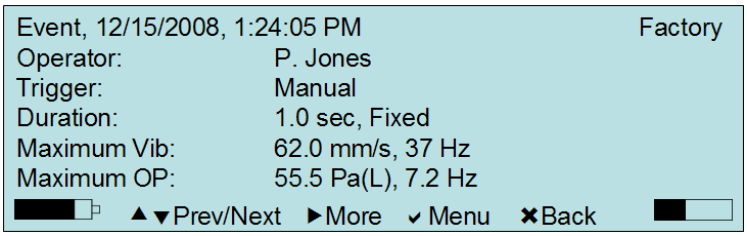
9.1. View Data Files

1. From the **Main Display**, select the **Down Arrow** key on the unit to access **View Data Files**.
2. A list of recorded Events will appear. Press the **Up** or **Down Arrow** keys on the unit to highlight and select **Next/Prev** Events. Press and hold the **Down** or **Up Arrow** key to scroll through Events more quickly. Each Event type that is recorded with a particular **Record Mode**, **Waveform** or **Histogram**, has a different icon:

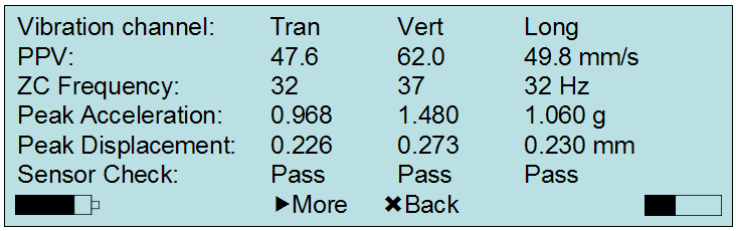

SYMBOL REPRESENTING A RECORDED HISTOGRAM
NUMBER OF EVENT FILES
Date Time Setup 1 of 8
10/15/2008 10:12:49a factory
10/15/2008 10:14:19a factory
10/15/2008 12:17:09a factory
10/23/2008 02:33:15a Reed Stone South Pit
10/23/2008 02:35:15a Reed Stone South Pit
▲▼Next/Prev ▶Detail ✔Menu ✖Exit
SYMBOL REPRESENTING A RECORDED WAVEFORM or OPTIONAL SOUND LEVEL MICROPHONE

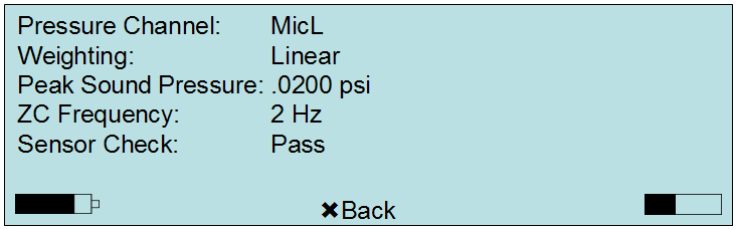
   a. Within the **View Data** window, select the **Right Arrow** key to display the **Detail** of a selected Event. Below is an example of the **Detail** feature for a ***Waveform Event***:

      i. Press the **Right Arrow** key to review **More** data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:

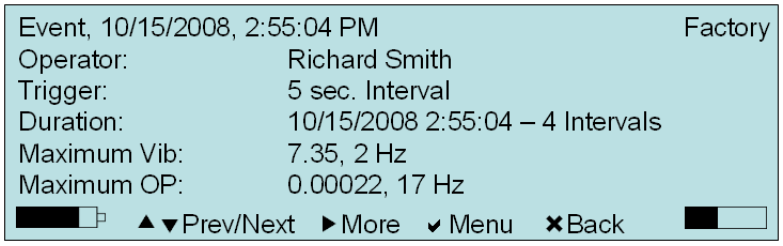

Event, 12/15/2008, 1:24:05 PM Factory
Operator: P. Jones
Trigger: Manual
Duration: 1.0 sec, Fixed
Maximum Vib: 62.0 mm/s, 37 Hz
Maximum OP: 55.5 Pa(L), 7.2 Hz
▲▼Prev/Next ▶More ✔Menu ✖Back

      ii. Each Event has several pages of data. Continue to press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:

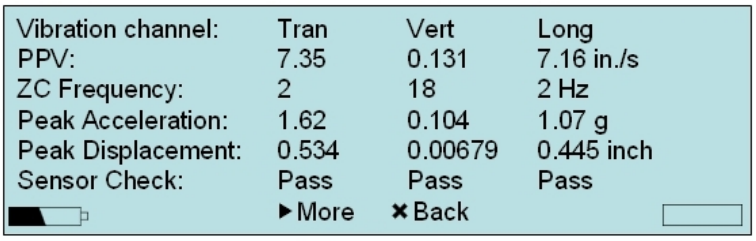

Vibration channel: Tran Vert Long
PPV: 47.6 62.0 49.8 mm/s
ZC Frequency: 32 37 32 Hz
Peak Acceleration: 0.968 1.480 1.060 g
Peak Displacement: 0.226 0.273 0.230 mm
Sensor Check: Pass Pass Pass
▶More ✖Back



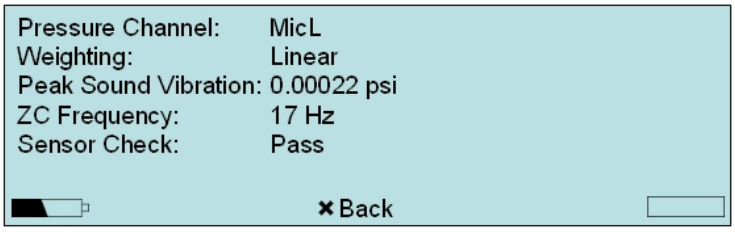
b. Within the **View Data** window, select the **Right Arrow** key to display the **Detail** of a selected **Histogram** Event. Below is an example of the **Detail** feature for a ***Histogram Event***:


Event, 10/15/2008, 2:55:04 PM
Factory
Operator: Richard Smith
Trigger: 5 sec. Interval
Duration: 10/15/2008 2:55:04 – 4 Intervals
Maximum Vib: 7.35, 2 Hz
Maximum OP: 0.00022, 17 Hz
▲▼Prev/Next ▶More ✔Menu ✖Back

i. Press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:


Vibration channel: Tran Vert Long
PPV: 7.35 0.131 7.16 in./s
ZC Frequency: 2 18 2 Hz
Peak Acceleration: 1.62 0.104 1.07 g
Peak Displacement: 0.534 0.00679 0.445 inch
Sensor Check: Pass Pass Pass
▶More ✖Back

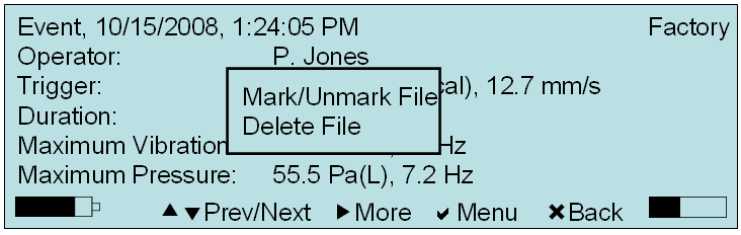
ii. Each Event has several pages of data. Continue to press the **Right Arrow** key to review more data associated with the selected Event, or the **Cancel** key to go **Back** to the previous menu:



3. If you press **Cancel** to go **Back** while viewing the last page, the next page displays the first page that you viewed. Press the **Cancel** key to return to the **Main Display**.

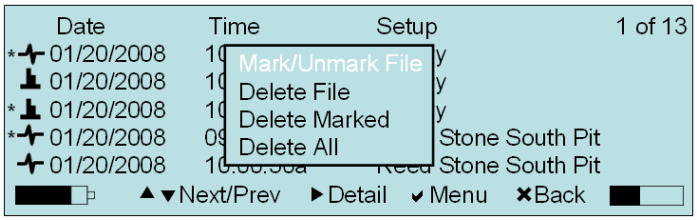
   NOTE: The settings and data may vary from the examples shown above, dependent on the **Setup File** used or Event viewed.

4. While viewing the **Detail** of an Event, you are able to **Mark** the file for deletion, or remove the file while viewing it by pressing the **Enter** key to access the **Mark/Unmark File** and **Delete File** commands. If you delete a file while viewing the detail, you will be returned to the **View Data Files** screen.



5. Access the **View Data Files** menu to **Mark/Unmark File** multiple files and subsequently **Delete** them, or **Delete All** files, whether they are marked or not. When an Event is highlighted and then **Marked**, an **Asterisk** will appear beside at the far left side of the screen.

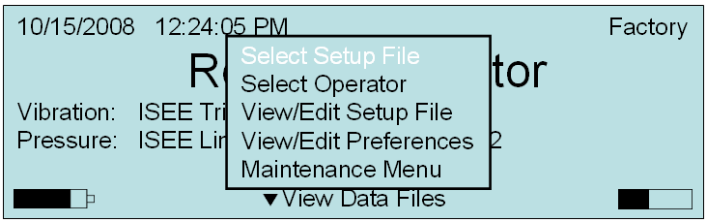
   NOTE: A **Marked** file will have an asterisk placed to the left of the file within the **View Data** window, as shown below.



9.2. Select Setup File

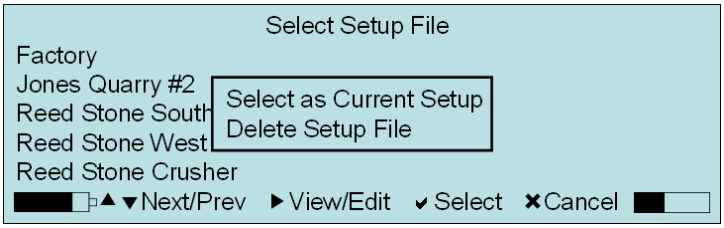
Previously saved setup files can be selected as the default setup file or deleted. These files are created when you have edited and saved settings within the **View/Edit Setup File** menu, or when you have edited settings within the **Blastware Setup** menu and downloaded them to the unit.

1. From the main menu on the monitor, select the **Setup** key on the unit to access the main setup selection menu. Press the **Enter** key to access **Select Setup File**.



2. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev Setup Files**. Highlight the **Setup** file that you want to use or delete. Press the **Enter** key to access the popup menu.

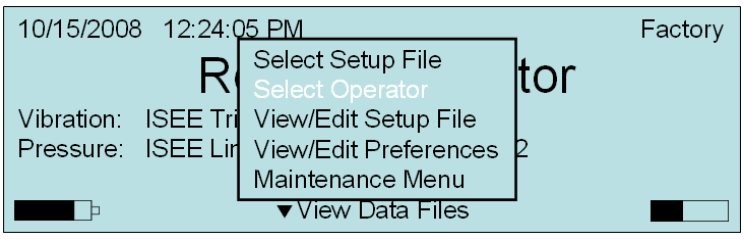
3. Press the **Up** or **Down Arrow** key to highlight **Select Current Setup**, to use the file as the default setup, or **Delete Setup File** to permanently remove the file from the unit. Press the **Cancel** key to exit the **Select Setup File** menu.



9.3. Select Operator

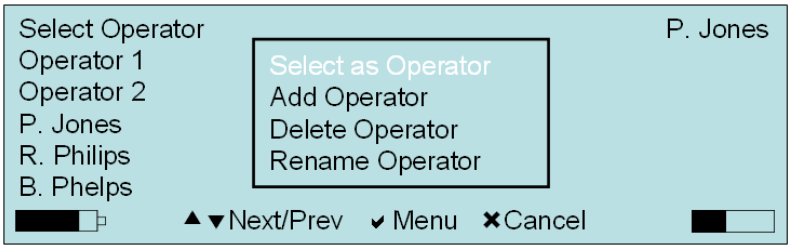
Operator names can be deleted, renamed, or added. The current operator name is displayed on the **Event Reports** and at the upper right-hand corner of the **Select Operator** menu.

1. From the **Main Display** on the monitor, select the **Setup** key on the unit to access **Main Menu**. Press the **Down Arrow** key and highlight the **Select Operator** menu item. Press the **Enter** key to access **Select Operator**.



2. Press the **Up** or **Down Arrow** keys on the unit to highlight the **Next/Prev** operator.
3. Press the **Enter** key to **Select** an **Operator** for the unit.

4. Within the **Operator** screen, you can also **Add**, **Delete**, and **Rename** an operator. Select the **Enter** key to access the popup **Menu**. Access the **Rename Operators** command by highlighting the **Operator** and using the **Right Arrow** key to access the editing screen.



   a. To use the **Select as Operator** command, press the **Up** or **Down Arrow** keys on the unit to highlight the operator you would like to select. Press the **Enter** key to access the **Menu**. Press the **Up** or **Down Arrow** keys on the unit to highlight **Select as Operator**. The unit will respond with a message confirming the selection and the name of the operator is shown in the upper right corner.

   b. To use the **Add Operator** command, Press the **Enter** key to access the **Menu**. Press the **Up** or **Down Arrow** keys on the unit to highlight **Add Operator**. Within the edit menu, use the **Right** and **Left Arrow** keys to navigate between the character fields, and the **Up** or **Down Arrow** keys to change the characters. Press the **Enter** key to **Save** the operator name, or the **Cancel** key to exit to the previous menu.

   c. To use the **Delete Operator** command, press the **Up** or **Down Arrow** keys on the unit to highlight the operator you would like to delete. Press the **Enter** key to access the **Menu**. Press the **Up** or **Down Arrow** keys on the unit to highlight **Delete Operator**. Press **Enter** to delete the selected operator.

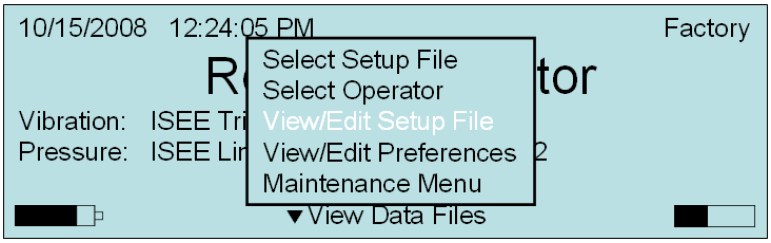
   d. To use the **Rename Operator** command, press the **Up** or **Down Arrow** keys on the unit to highlight the operator you would like to rename. Press the **Enter** key to access the **Menu**. Press the **Up** or **Down Arrow** keys on the unit to highlight **Rename Operator**. Within the edit menu, use the **Right** and **Left Arrow** keys to navigate between the character fields, and the **Up** or **Down Arrow** keys to change the characters. Press the **Enter** key to **Save** the operator name, or the **Cancel** key to exit to the previous menu.

      NOTE: Operator names are limited to 15 characters.

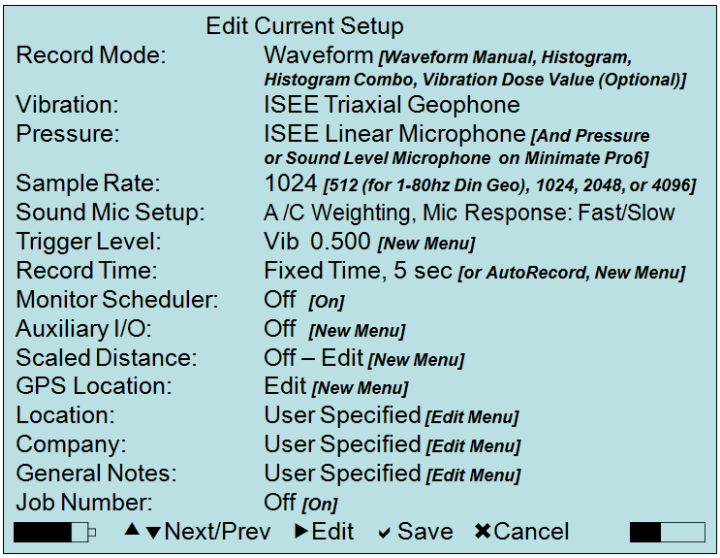
9.4. View/Edit Setup File

The **View/Edit Setup File** menu allows you to configure the **Record Mode** and related settings of the unit prior to monitoring an Event. You can change the setups using the monitor commands or by using a personal computer running the **Blastware** software. This section outlines the procedures to change the setups using the **Minimate Pro** keyboard. For information on how to change the setups using a personal computer and **Blastware**, refer to the **Blastware Operator Manual**.

1. From the main menu on the monitor, select the **Setup** key on the unit to access the main setup selection menu. Use **Down Arrow** key and highlight the **View/Edit Setup File** menu item. Press the **Enter** key to select **View/Edit Setup File**.



2. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev Setup** options.
3. Press the **Right Arrow** key to select a **Setup** option for editing or viewing.
4. At any time, press the **Cancel** key to return to the previous screen.
5. The image below indicates in "***[…]***" the result of a **Right Arrow** key selection – if a ***[New Menu]*** is shown, continue to the corresponding part of this section for more information:


Edit Current Setup
Record Mode: Waveform [Waveform Manual, Histogram, Histogram Combo, Vibration Dose Value (Optional)]
Vibration: ISEE Triaxial Geophone
Pressure: ISEE Linear Microphone [And Pressure or Sound Level Microphone on Minimate Pro6]
Sample Rate: 1024 [512 (for 1-80hz Din Geo), 1024, 2048, or 4096]
Sound Mic Setup: A /C Weighting, Mic Response: Fast/Slow
Trigger Level: Vib 0.500 [New Menu]
Record Time: Fixed Time, 5 sec [or AutoRecord, New Menu]
Monitor Scheduler: Off [On]
Auxiliary I/O: Off [New Menu]
Scaled Distance: Off – Edit [New Menu]
GPS Location: Edit [New Menu]
Location: User Specified [Edit Menu]
Company: User Specified [Edit Menu]
General Notes: User Specified [Edit Menu]
Job Number: Off [On]
▲▼Next/Prev ▶Edit ✔Save ✖Cancel

a. Record Mode

The **Minimate Pro** offers the following recording modes; **Waveform**, **Waveform Manual**, **Histogram**, **Histogram Combo**, and the optional **Vibration Dose Value (VDV)**, available with the purchase of the **Blastware Advanced Module**.

A **Record Mode** determines how the **Minimate Pro** records Events. Refer to **Trigger Level**, **Record Time**, and **Timer Mode**, for additional parameters that determine how, when and the duration the unit records an Event or series of Events. A **Record Mode** can be activated at the unit by pressing the **Start Monitor** key at the main display, or remotely through cable or modem communications within **Blastware,** by selecting **Unit > Monitor > Start Monitor**. Refer to these options within the **Blastware Operator Manual**.

Each **Record Modes** is described in detail below:

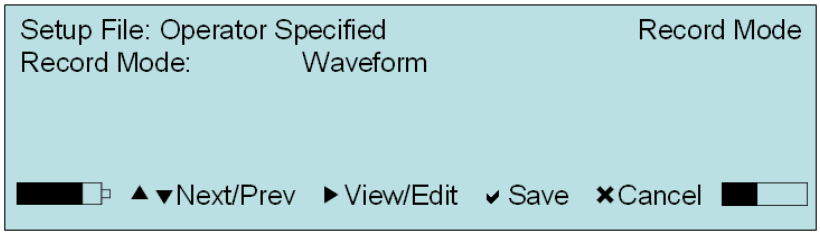
(1) Record Mode - Waveform

Use **Waveform Record Mode** to record multiple Events automatically; the unit monitors activity, waiting for an Event to exceed the preset **Trigger Level**, records the data, displays the results, and continues to monitor, ready to record following Events. The monitor records all Events whose activity exceeds a preset **Trigger Level**.

Use the **Waveform Record Mode** in conjunction with the **Monitor Scheduler** feature to record in the future, **Once, Daily**, **Weekly**, repeated as required, or set it to **Off** and record continuously based on the **Trigger Level** – the monitor records all Events whose activity exceeds the preset **Trigger Level** for the ISEE/DIN Geophone(s) and/or Linear Microphone.

(1)1. To select the Waveform Record Mode:

1. Within the **Edit Current Setup** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
2. Press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Record Mode** displays **Waveform**. The following menu will be displayed:

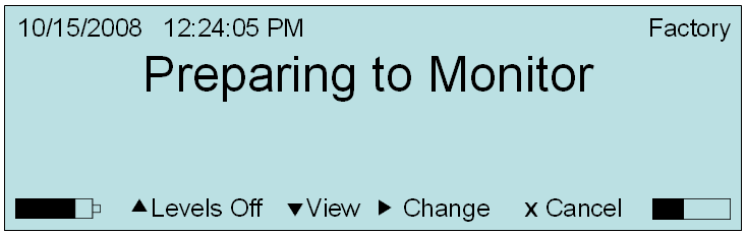


3. Press the **Enter** key to **Save** the new **Record Mode** setting.
4. Press the **Enter** key to **Save** the new **Current Setup** by overwriting the name displayed, or by creating a new **Setup File** name.
5. Press the **Cancel** key to return to the **Ready to Monitor** display.

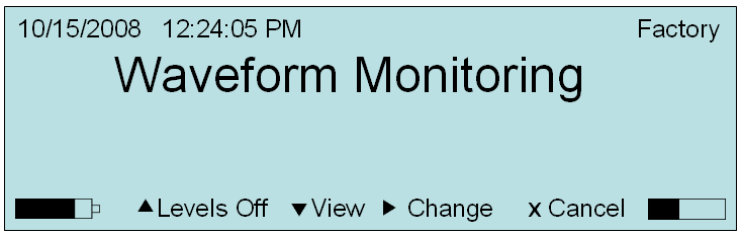
(1)2. Dynamic Recording Information – Waveform Record Mode

Viewing the **Dynamic Recording Information** displayed during the recording of a **Waveform** Event:

1. Once the **Record Mode** has been selected and the **Event** recording begins, the unit will briefly display the following message:

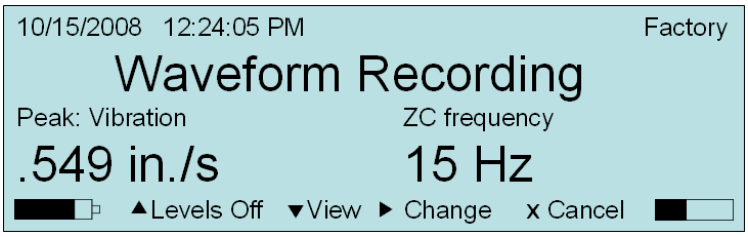


2. The unit will then enter **Waveform Record Mode** and began monitoring for Events:

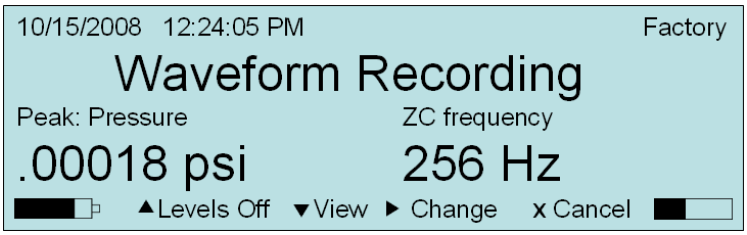


NOTE: A message, **Sensor Check**, will appear if it has been activated in the **Preferences** menu. Refer to **Sensor Check** under the **View/Edit Preferences** Section of this manual to learn more about the feature and to determine when it will be activated. The **Sensor Check** setting will determine when it will notify that it is occurring, **Before Monitoring** or **After Event**, or not at all if it is **Disabled**.

3. During recording, the **Peak** results and **Zero Crossing (ZC)** Frequency of the recorded Event appear on the display, as shown below:



4. Press the **Right Arrow** to **Change** between **Peak Vibration** (shown above) and **Peak Overpressure** results. Below is an example of the **Peak: Pressure** and **ZC Frequency** readouts that are dynamically displayed:



NOTE: There is a 1/3 second delay between an Event ending and the level data being displayed. If an Event is triggered during that delay the display is not updated until the delay has passed.

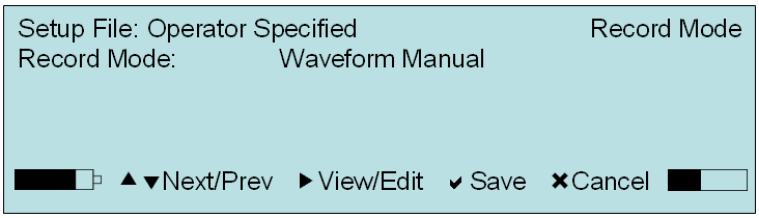
5. At any time, during, before or after recording, you can push the **Up Arrow** key to turn **Levels Off** and the display will no longer be updated with the **Peak** and **ZC Frequency** information. Press the **Up Arrow** key to turn them on again.

(2) Record Mode - Waveform Manual:

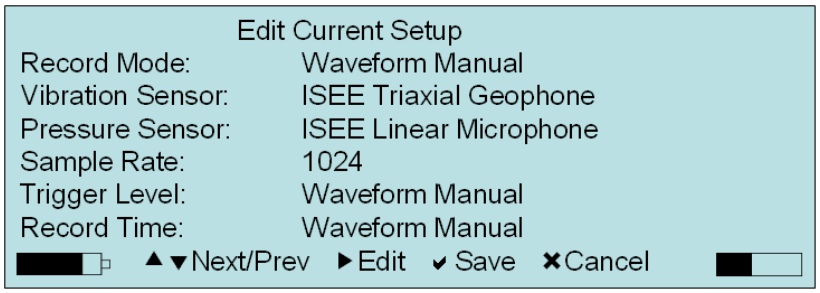
Use **Waveform Manual Record Mode** option and **Start Monitor** key if automatic triggering is unreliable, due to excessive wind or nearby vehicle activity, or to record the background noise level in the vicinity of a site.

(1)1. To select the Waveform Manual Record Mode:

1. Within the **Edit Current Setup** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
2. Press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Record Mode** displays **Waveform Manual**. The following menu will be displayed:



3. Press the **Enter** key to **Save** the new **Record Mode** setting.
4. Note the changes within the **Edit Current Setup** menu. The **Record Mode**, **Trigger Level**, and **Record Time** have all changed to **Waveform Manual** settings:

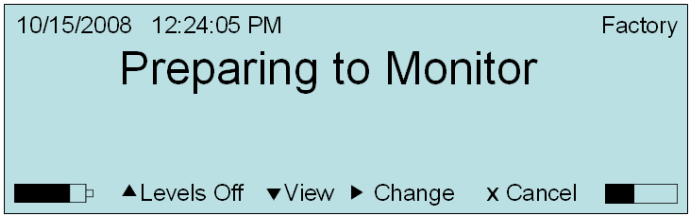

Edit Current Setup
Record Mode: Waveform Manual
Vibration Sensor: ISEE Triaxial Geophone
Pressure Sensor: ISEE Linear Microphone
Sample Rate: 1024
Trigger Level: Waveform Manual
Record Time: Waveform Manual
▲▼Next/Prev ▶Edit ✔Save ✖Cancel

5. Press the **Enter** key to **Save** the new **Record Mode** setting.
6. Press the **Enter** key again to **Save** the new **Current Setup** by overwriting the name displayed, or by creating a new **Setup File** name.
7. Press the **Cancel** key to return to the **Ready to Monitor** display.

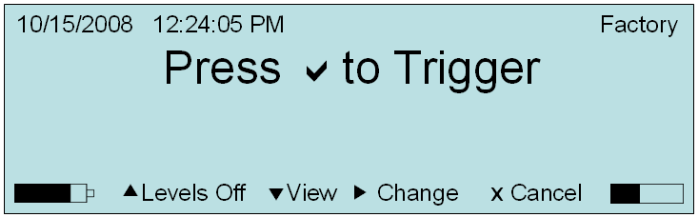
(1)2. Dynamic Recording Information –Waveform Manual Record Mode

Viewing the **Dynamic Recording Information** displayed during the recording of a **Waveform Manual** Event:

1. Once the **Record Mode** has been selected and the **Event** recording begins, the unit will briefly display the following message:



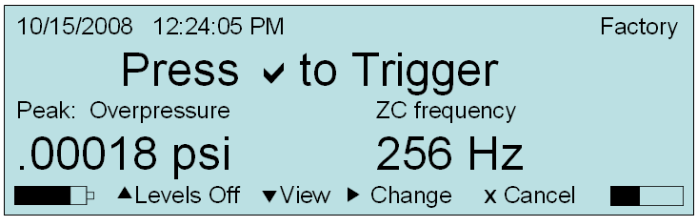
2. For **Waveform Manual**, the unit then displays the following message:

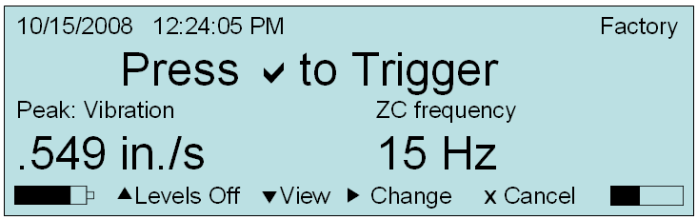


Press the **Enter** key to **Trigger** the recording process manually if you have selected the **Waveform Manual Record Mode**, otherwise the unit will start monitoring using the parameters set in the **Setup** and **Preferences** menus, such as the **External Trigger** option.

NOTE: A message, **Sensor Check**, will appear if it has been activated in the **Preferences** menu. Refer to **Sensor Check** under the **View/Edit Preferences** Section of this manual to learn more about the feature and to determine when it will be activated. The **Sensor Check** setting will determine when it will notify that it is occurring, **Before Monitoring** or **After Event**, or not at all if it is **Disabled**.

3. After pressing **Cancel**, the **Peak** results and **Zero Crossing (ZC)** Frequency of the recorded Event appear on the display. Press the **Right Arrow** to **Change** between **Peak Vibration** and **Peak Overpressure** results. Below is an example of the two **Peak** and **ZC Frequency** readouts that are dynamically displayed:





4. After recording, you can push the **Up Arrow** key to turn **Levels Off** and the display will no longer show the **Peak** and **ZC Frequency** information. Press the **Up Arrow** key to turn them on again.
5. Press **Cancel** to return to the **Main Display**.

(3) Record Mode – Histogram:

Use the **Histogram Record Mode** for long-term recording periods such as monitoring of pile driving operations.

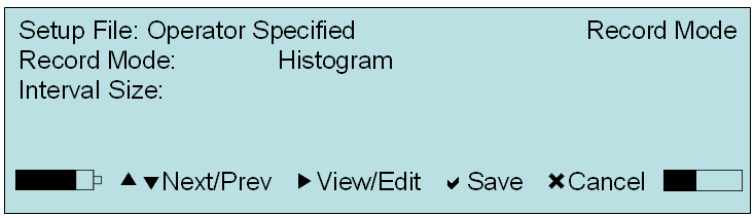
In **Histogram Record Mode**, the unit stores summary information in intervals, determined by the **Interval Size** setting, located within the **Record Mode** menu. The unit continues to sample data continuously at the chosen sample rate but only stores the relevant peaks for the selected **Interval Size**. This reduces the data recorded and greatly increases the monitor storage capacity. For each interval, the monitor calculates the maximum peaks, the frequency of the largest peak, and the peak vector sum. For each channel, the maximum peak and its frequency are calculated. Also the largest peak vector sum is calculated over the entire Event.

NOTE: The **Histogram Record Mode** consumes more battery power than other record modes. We recommend connecting a monitor to the supplied AC adapter or an external 12 VDC power supply.

NOTE: If you have purchased the optional **Ethernet®** communication cable in conjunction with the **Blastware Advanced Module**, you can view Histogram data in real-time. Refer to the that feature section for more information.

To select the Histogram Record Mode:

1. Within the **Edit Current Setup** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
2. Press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Record Mode** displays **Histogram**. The following menu will be displayed:



3. Press the **Right Arrow** key until the **Histogram** option appears.
4. Press the **Down Arrow** key and highlight **Interval Size**.
5. Press the **Right Arrow** key to access the editing function. Press the **Up** or **Down** Arrow key to modify the **Interval Size**.

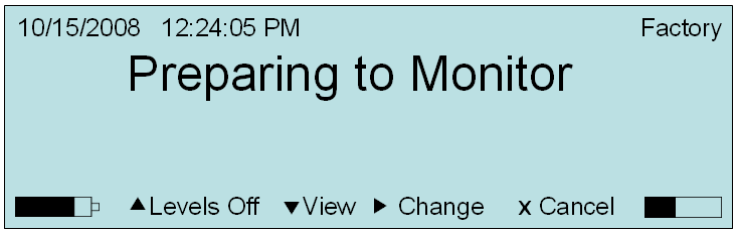
NOTE: The **Interval Size** may be set from 2 – 30 in seconds, or 1 – 60 in minutes.

6. Press the **Enter** key to **Save** the new **Interval Size** setting.
7. Press the **Enter** key again to **Save** the new **Record Mode** setting.
8. Press the **Enter** key again to **Save** the new **Current Setup** by overwriting the name displayed, or by creating a new **Setup File** name.
9. Press the **Cancel** key to return to the **Ready to Monitor** display.

(1)1. Dynamic Recording Information – Histogram Record Mode

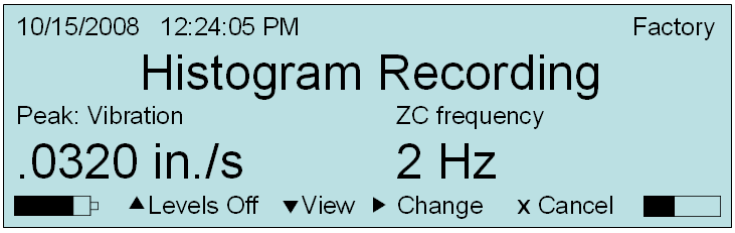
Viewing the **Dynamic Recording Information** displayed during the recording of a **Histogram** Event:

1. Once the **Record Mode** has been selected and the **Event** recording begins, the unit will briefly display the following message:

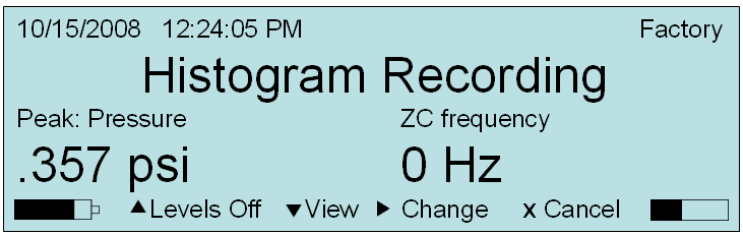


NOTE: A message, **Sensor Check**, will appear if it has been activated in the **Preferences** menu. Refer to **Sensor Check** under the **View/Edit Preferences** Section of this manual to learn more about the feature and to determine when it will be activated. The **Sensor Check** setting will determine when it will notify that it is occurring, **Before Monitoring** or **After Event**, or not at all if it is **Disabled**.

2. The unit then begins to monitor using the parameters set in the **Setup** and **Preferences** menus:

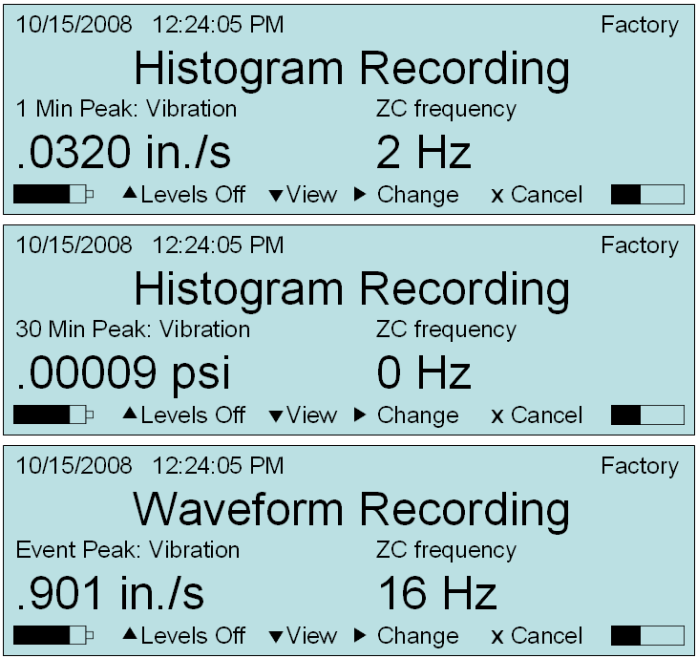


3. During recording, the **Peak** results and **Zero Crossing (ZC) Frequency** of the recorded Event appear on the display, as shown above.
4. Press the **Right Arrow** to **Change** between **Peak Vibration** and **Peak Overpressure** results. Below is an example of the **Peak** and **ZC Frequency** readouts that are dynamically displayed – notice that the **Pressure** units have changed from **in./s**, shown in the image above, to **psi**:



5. If the **Interval Size** within the **Edit Current Setup > Record Mode** menu has been set to over 30 seconds, then the **Event Peak: Vibration**, **1 Min. Peak: Vibration**, and **30**

Second Peak: Vibration values can be viewed by pressing the **Right Arrow** key for each, as shown below:



(4) **Record Mode - Histogram Combo:**

Use the **Histogram Combo Record Mode** for long-term recording periods such as monitoring of pile driving where you may have larger amounts of time between each pile driving operation.

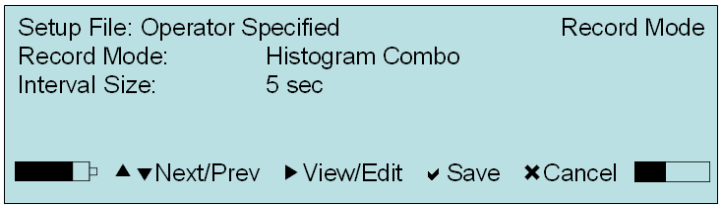
This **Record Mode** creates a waveform during recording if the signal exceeds the waveform trigger level. The waveform Event is saved as a separate file while the histogram Event file remains continuous. The **Auxiliary Trigger** is disabled during histogram combo mode, and the **Record Time > Record Stop Mode** must be set to **Fixed**.

In **Histogram Combo Record Mode**, the unit stores summary information in intervals, determined by the **Interval Size** setting, located within the **Record Mode** menu. The unit continues to sample data continuously at the chosen sample rate but only stores the relevant peaks for the selected **Interval Size**. This reduces the data recorded and greatly increases the monitor storage capacity. For each interval, the monitor calculates the maximum peaks, the frequency of the largest peak, and the peak vector sum. For each channel, the maximum peak and its frequency are calculated. Also the largest peak vector sum is calculated over the entire Event.

NOTE: The **Histogram Combo Record Mode** consumes more battery power than other record modes. We recommend using an AC adapter or an external 12 VDC power supply.

(1)1. To select the Histogram Combo Record Mode:

1. Within the **Edit Current Setup** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
2. Press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Record Mode** displays **Histogram Combo**:



3. Press the **Down Arrow** key and highlight **Interval Size**.
4. Press the **Right Arrow** key to access the editing function. Press the **Up** or **Down** Arrow key to modify the **Interval Size**.
5. Press the **Enter** key to **Save** the new **Interval Size** setting.

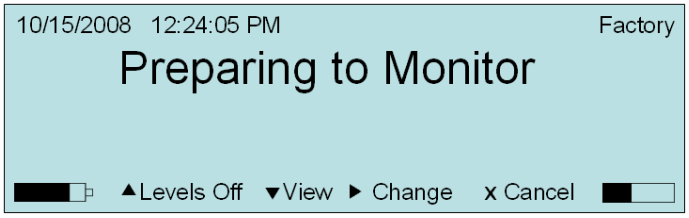
NOTE: The **Interval Size** may be set from 2 – 30 in seconds, or 1 – 60 in minutes.

6. Press the **Enter** key again to **Save** the new **Record Mode** setting.
7. Press the **Enter** key again to **Save** the new **Current Setup** by overwriting the name displayed, or by creating a new **Setup File** name.
8. Press the **Cancel** key to return to the **Ready to Monitor** display.

(1)2. Dynamic Recording Information – Histogram Combo Record Mode

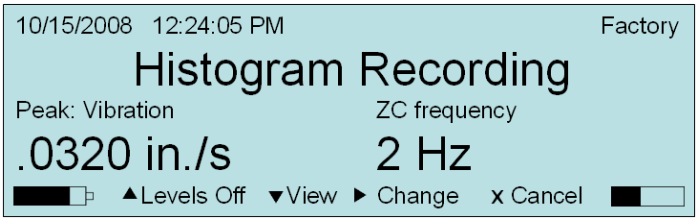
Viewing the **Dynamic Recording Information** displayed during the recording of a **Histogram Combo** Event:

1. Once the **Record Mode** has been selected and the **Event** recording begins, the unit will briefly display the following message:

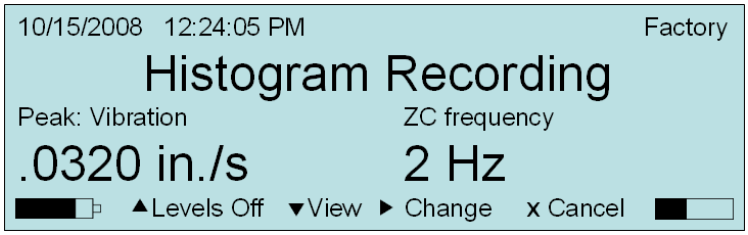


NOTE: A message, **Sensor Check**, will appear if it has been activated in the **Preferences** menu. Refer to **Sensor Check** under the **View/Edit Preferences** Section of this manual to learn more about the feature and to determine when it will be activated. The **Sensor Check** setting will determine when it will notify that it is occurring, **Before Monitoring** or **After Event**, or not at all if it is **Disabled**.

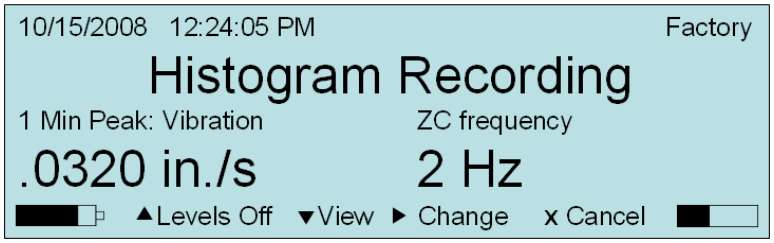
2. The unit then begins to monitor using the parameters set in the **Setup** and **Preferences** menus:

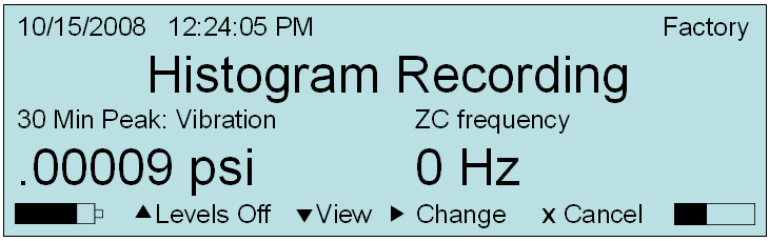


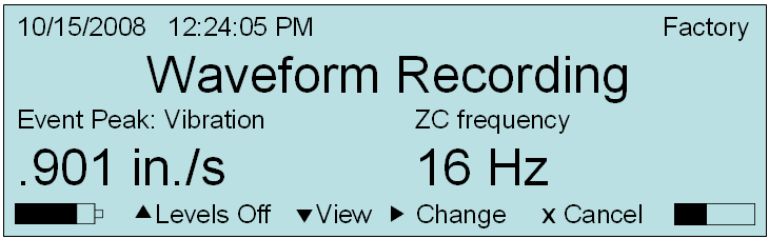
3. During recording, the **Peak** results and **Zero Crossing (ZC) Frequency** of the recorded Event appear on the display, as shown above.
4. Press the **Right Arrow** to **Change** between **Peak Vibration** and **Peak Overpressure** results. Below is an example of the **Peak** and **ZC Frequency** readouts that are dynamically displayed – notice that the **Pressure** units have changed from **in./s**, shown in the image above, to **psi**:



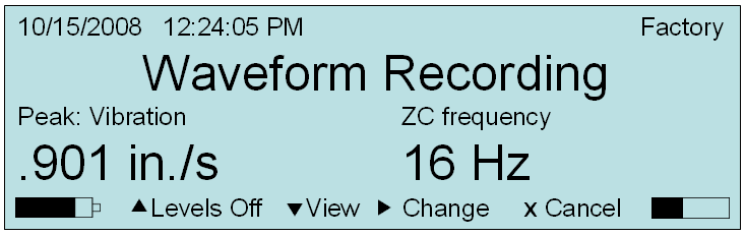
5. If the **Interval Size** within the **Edit Current Setup > Record Mode** menu has been set to over 30 seconds, then the **Event Peak: Vibration**, **1 Min. Peak: Vibration**, and **30 Second Peak: Vibration** values can be viewed by pressing the **Right Arrow** key for each, as shown below:

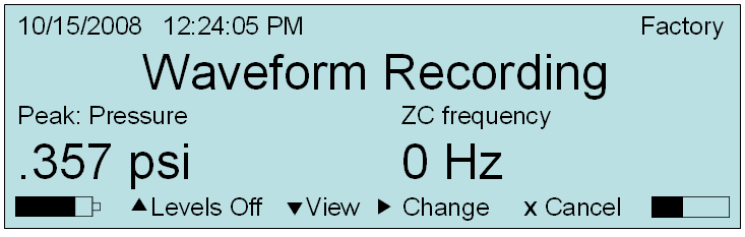






6. If a **Waveform** recording is triggered, then the information for **Pressure** and **Vibration** is also available while the **Waveform Recording** message is displayed:





(5) Record Mode - Vibration Dose Value (VDV) [Optional]

The optional **Vibration Dose Value** (**VDV**) **Record Mode** is available on the unit with the purchase of the **Instantel® Blastware Advanced Module** software. To order your copy of the **Blastware Advanced Module**, please contact your **Instantel Dealer Representative**. If you have a licensed copy of the **Blastware Advanced Module**, follow the instructions in the **Blastware Operator Manual** for **Reloading the Operating System** of the **Minimate Pro**, which will also load the **VDV** recording mode into the unit if it is not already there.

The **VDV** monitoring option is used to measure and determine whole-body vibration based on a **Frequency Weighting** file that is downloaded from **Blastware**. The **VDV Record Mode** will not be allowed unless a **Frequency Weighting** file is downloaded to the unit. Your geographic location and the type of vibration that you are monitoring will determine which **Frequency Weighting** file that you choose to use during the monitoring session – the frequency range of the data collected is from 1 to 80 Hz, therefore the **Instantel 1-80 Hz DIN Geophone** (Part No. 720A2003) is required for this type of recording, as the sample rate is reduced to 512 s/s. Multiple **VDV** frequency weight files may be downloaded to the monitor using the **Blastware Advanced Module** software. Refer to the **Blastware Operator Manual** for more information on how to download weight files to the unit.

While monitoring, the unit differentiates the velocity data into acceleration, applies the frequency weighting and then calculates the **VDV** and **Root Mean Square** (**RMS**) values. The unit displays the **VDV** and **RMS** values every ten seconds while recording, and stores the final calculations as part of the file and Event Report.

There are two primary standards for determining and evaluating whole-body vibration, as follows:

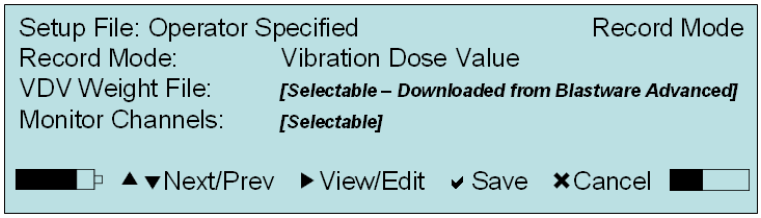
BS-6841	Measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock.
ISO-2631	Evaluation of human exposure to whole body vibration.

These **Series IV** units are capable of continuously monitoring full waveform data for 24 hours; the daytime **VDV** monitoring is performed on the vertical channel (7:00 AM to 11:00 PM) while the nighttime **VDV** monitoring is performed on two horizontal channels (11:00 PM to 7:00 AM) – the same or different Frequency Weight file can be use for each of these monitoring periods.

NOTE: The **VDV Record Mode** consumes more battery power than other record modes. We recommend connecting the monitor to the supplied AC adapter or an external 12 VDC power supply.

(1)1. To select the Vibration Dose Value Record Mode:

1. Within the **Edit Current Setup** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
2. Press the **Right Arrow** key to access the menu. Continue to press the **Right Arrow** key until the **Record Mode** displays **Vibration Dose Value**. The following menu will be displayed:



3. Within the **Record Mode** menu, press the **Up** or **Down** key to locate and highlight the **Record Mode** menu option.
4. Press the **Right Arrow** key until the **Vibration Dose Value** option appears.
5. Press the **Up** or **Down Arrow** key and highlight **VDV Weight File**.
6. Press the **Right Arrow** key to select one of the weight files. The following **VDV Weight Files** are available within **Blastware** for download to the unit: BW6841wb, BW6841wd, BW6841we, BW6841wf, BW6841wg, and ISO2631.

   Refer to each specific standard, **BS-6841** or **ISO-2631** for detailed information on each weighting file, in regards to the wb, wd, we, wf, wg, and wm names.

   NOTE: Multiple **VDV Weight Files** can be downloaded from **Blastware**. Refer to the **Blastware Operator Manual** for more information on how to download weight files.

7. Next, press the **Down Arrow** key to highlight **Monitor Channels**.
8. Press the **Right Arrow** key to select the channel(s) of the geophone that you wish to monitor (**Tran**, **Vert**, **Long**, **Tran/Vert**, **Vert/Long**, **Tran/Long** or **Tran/Vert/Long**). This selection should be based on the time of day you are monitoring.
9. Press the **Enter** key again to **Save** the new **Current Setup** by overwriting the name displayed, or by creating a new **Setup File** name.
10. Press the **Cancel** key to return to the **Ready to Monitor** display.

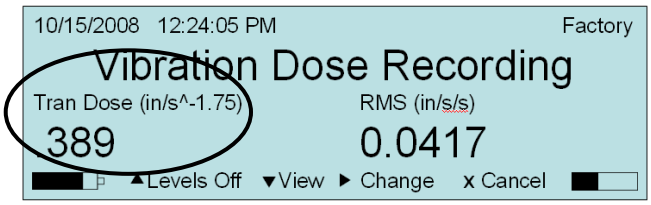
(1)2. Dynamic Recording Information – Vibration Dose Value Record Mode

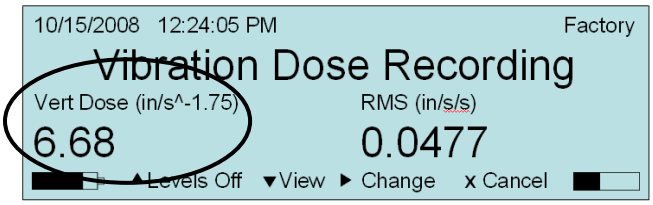
Viewing the **Dynamic Recording Information** displayed during the recording of a **Vibration Dose Value** recording session:

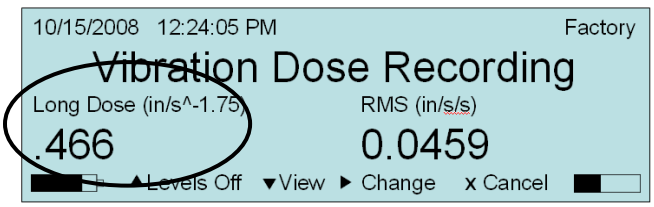
1. Once the **Record Mode** has been selected, select **Start Monitor**

NOTE: A message, **Sensor Check**, will appear if it has been activated in the **Preferences** menu. Refer to **Sensor Check** under the **View/Edit Preferences** Section of this manual to learn more about the feature and to determine when it will be activated. The **Sensor Check** setting will determine when it will notify that it is occurring, **Before Monitoring** or **After Event**, or not at all if it is **Disabled**.

2. Every ten seconds the dynamic display will update the **Dose** and **RMS** values, with the final values stored with the **Event**. Press the **Right Arrow** key to toggle between **Tran Dose**, **Vert Dose**, and **Long Dose**, as shown below:







b. Vibration Sensor (Minimate Pro4 and Minimate Pro6):

The **Vibration Sensor** option represents **Channels 1-3**, and the connector is located on the side of the **Minimate Pro** and is labeled **Vibration**. The color of the label is blue.

(1) Scroll down to highlight **Vibration Sensor**

(2) Press the **Right Arrow** key to either select the **ISEE** or **DIN Geophone** or turn the **Vibration** channel **Off**.

c. Pressure Sensor (Minimate Pro4):

The **Pressure Sensor** option represents **Channel 4**, and the connector is located on the side of the **Minimate Pro** and is labeled **Pressure**. The color of the label is red.

(1) Scroll down to highlight **Pressure Sensor**

(2) Press the **Right Arrow** key to either select the **ISEE Linear Microphone** or turn the **Pressure** channel **Off**.

d. Pressure Sensor (Minimate Pro6):

The **Pressure Sensor** option represents Channels 4-6, and the connector is located on the side of the **Minimate Pro** and is labeled **Pressure**. On the **Minimate Pro6**, an ISEE or DIN Geophone, or ISEE Linear Microphone, may be attached. The color of the label is red and blue.

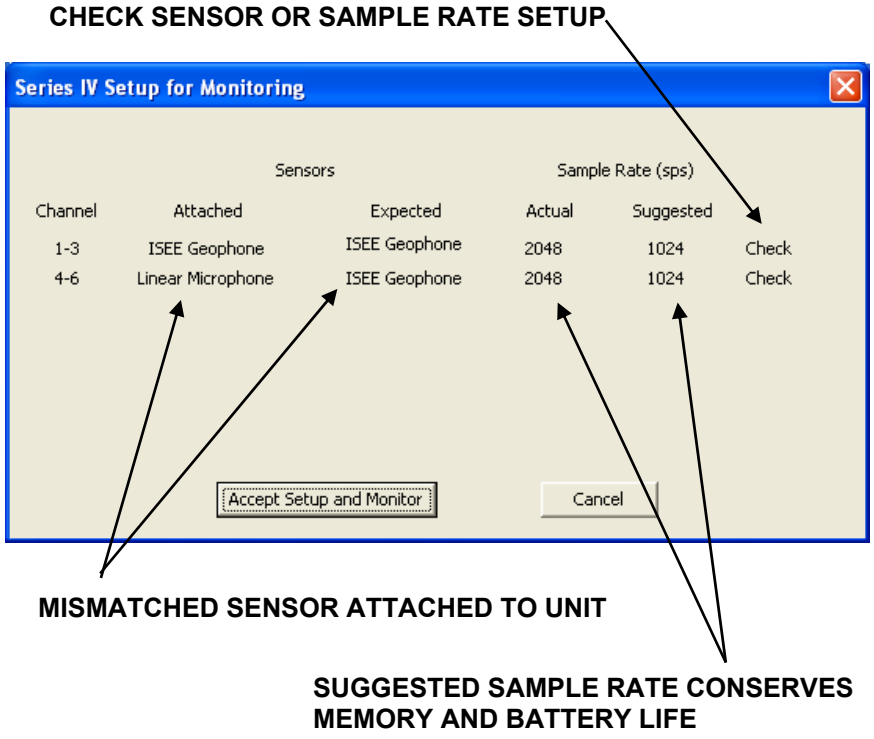
(1) Scroll down to highlight **Pressure Sensor**

(2) Press the **Right Arrow** key to either select the **Linear Microphone**, **ISEE** or **DIN Geophone** or turn the **Pressure** Channel **Off**.

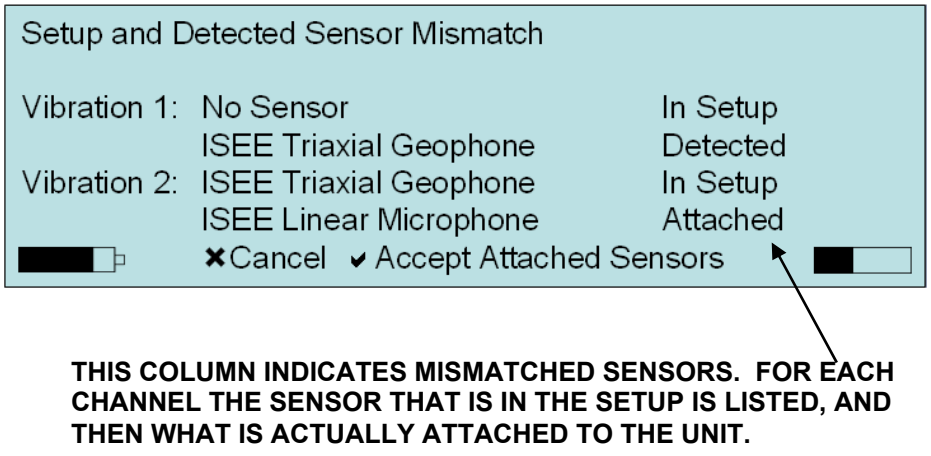
NOTE: The selected sensors within **View/Edit Setup File** should match what is attached to the unit. If the **Vibration Sensor** channel is **Off** and an **ISEE** or **DIN Geophone** is attached, or if it is **On**, and an **ISEE** or **DIN Geophone** is not attached but it appears in the setup file, the **Sensor Check** will return the message, "Sensor Detection Error – Attached Sensors do not match setup".

If you receive a **Sensor Detection Error**, you must decide whether or not to **Accept** or **Cancel** the setup and fix the issue. Suggested sensors and sample rates are also displayed in **Blastware** when you use the **Unit > Monitoring** dialog. Below are two examples of **Sensor Detection Error** and/or sample rate suggestions on the unit and within **Blastware**:

Blastware Example:



Minimate Pro Example:


Setup and Detected Sensor Mismatch
Vibration 1: No Sensor
In Setup
ISEE Triaxial Geophone
Detected
Vibration 2: ISEE Triaxial Geophone
In Setup
ISEE Linear Microphone
Attached
✖Cancel ✔Accept Attached Sensors
THIS COLUMN INDICATES MISMATCHED SENSORS. FOR EACH CHANNEL THE SENSOR THAT IS IN THE SETUP IS LISTED, AND THEN WHAT IS ACTUALLY ATTACHED TO THE UNIT.

e. Sample Rate:

The **Minimate Pro** offers a number of sample rates including **512**, **1024**, **2048**, and **4096**, available on all channels.

The choice of a sample rate depends on the type of monitoring you are conducting. Increasing the sample rate increases the accuracy of the waveform recording. For this reason, set the sample rate according to the location of the Geophone. For Near-Field monitoring, set the sample rate to **4096** samples per second. For Far-Field monitoring, set the sample rate to **1024** samples per second. Increasing the sample rate also increases the amount of memory required to store Events and therefore reduces the number of Events that can be stored on the monitor. A higher sample rate also reduces the battery charge at a greater rate.

The **512** samples per second range is available in all monitor modes, but only recommended for the 1 – 80 Hz DIN Geophone and the **VDV Record Mode**. It is the only sample rate available for **VDV** recording.

To choose a sample rate, press the **Setups** key and press the **Down Arrow** key until the **Edit/View Setup File** option is highlighted. Press the **Enter** key to access the **Edit Current Setup** menu. Using the **Down Arrow** key, scroll through the windows until **Sample Rate** is highlighted.

(1) To edit the **Sample Rate,** press the **Right Arrow** key.

(2) Continue to press the **Right Arrow** key to change the sample value.

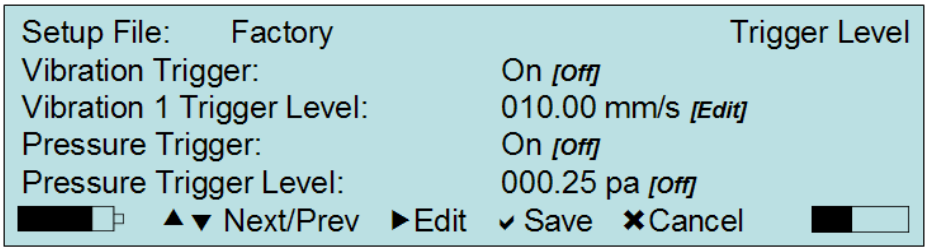
(3) Press the **Enter** key to **Save** the changes, or the **Cancel** key to return to the previous menu without saving the changes.

f. Trigger Level:

The **Trigger Level** sets a threshold that must be exceeded by an Events activity before the monitor begins recording. Use your judgment when setting a trigger level. You must set the level high enough so the unit does not trigger on unwanted Events such as nearby vehicle traffic. At the same time, you have to set the trigger level low enough so that an Events activity exceeds the trigger level and starts the unit recording.

The **Trigger Level** settings also determines trigger source which sets the **Minimate Pro** to trigger and start recording an Event automatically on ground vibrations, measured by the ISEE or DIN Geophone, or air pressure, measured by the ISEE Linear Microphone.

The **Minimate Pro** has three trigger source settings: **Vibration Trigger** alone, **Pressure Trigger** alone, or both **Vibration** and **Pressure Trigger** together. When you choose both, triggering occurs and recording begins if ground vibrations or air pressure exceeds the **Trigger Level** for either the ISEE or DIN Geophone, or the ISEE Linear Microphone.



(1) To set a **Trigger Level** for the Geophone, or **Vibration Trigger**, press the **Right Arrow** key to set the **Vibration Trigger** to **On**.

(2) Set the **Vibration Trigger Level** in mm/s or in/s, dependent on the **Units** selected in the **View/Edit Preferences** menu, by selecting the **Right Arrow** key

to edit the value. Press the **Right** and **Left Arrow** key to move from each value field. Press the **Up** or **Down Arrow** keys to change the value.

(3) To set a **Pressure Trigger** level for the Linear Microphone, or **Pressure Trigger**, press the **Right Arrow** key to set the **Pressure Trigger** to **On**.

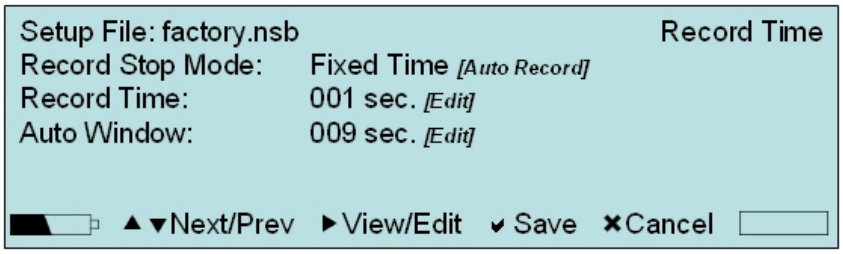
(4) Set the **Pressure Trigger Level** in mm/s or psi, dependent on the units selected in the **View/Edit Preferences** menu, by selecting the **Right Arrow** key to edit the value. Press the **Right** and **Left Arrow** key to move from each value field. Press the **Up** or **Down Arrow** keys to change the value.

(5) Press the **Enter** key to **Save** the changes, or the **Cancel** key to return to the previous menu without saving the changes.

NOTE: Refer to the **Auxiliary I/O** feature in this section for more information on alternative ways to trigger the **Minimate Pro** unit.

g. Record Time:

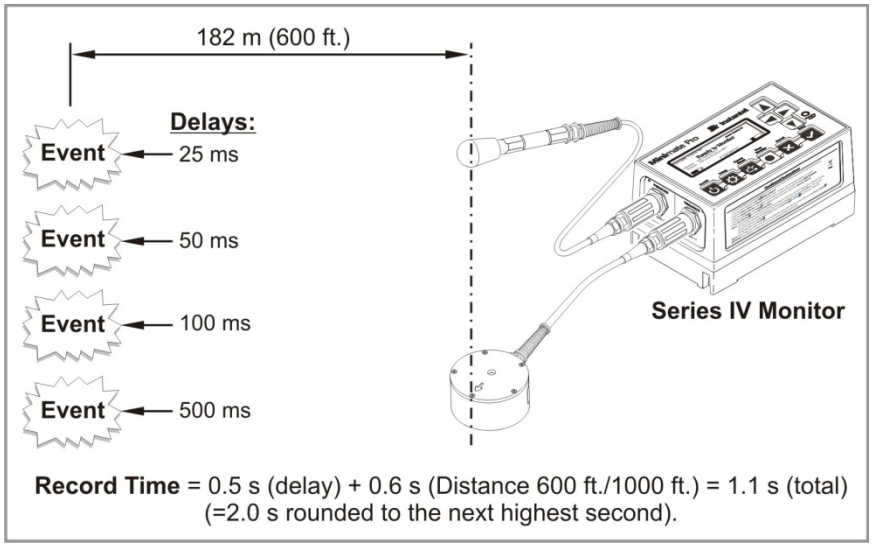
Select the **Record Time** feature if using the **Waveform** or **Waveform Manual** recording modes. Within the **Record Time** feature, there are three options, **Record Stop Mode**, **Record Time**, and **Auto Window**, as shown below:



The **Record Stop Mode** sets how the unit stops recording after being triggered. You can choose between a **Fixed Time** setting or an **Auto Record** setting. **Fixed Time** sets the record time to a specified length. For example, you set the unit to record for two seconds; once the record time has elapsed, the unit stops recording. In **Auto Record** the unit continues to record **Event** activity as long as that activity remains above the trigger level. (Sufficient memory and battery power must be available). Recording stops at a specified period of time after the **Event** activity falls below the trigger level. The period of time, called the **Auto Window**.

Remember to set the **Record Time** long enough to record an entire **Event** but not too long to avoid recording unnecessary data and filling the unit memory. Set a Record Time for **Waveform** and **Waveform Manual** record modes.

A helpful rule of thumb when setting a **Record Time** for a blast **Event** is to add the delays between detonating holes or use the longest delay, then add one second for each one thousand feet (300 m) from the **Event** to the unit to account for the speed of sound. For example, in the figure below the minimum record time required is 1.1 seconds. To be on the safe side and ensure you record all of the Event activity, set the **Record Time** to 2.0 seconds. As there is no single method for setting a **Record Time**, use your knowledge and experience to determine the setting.



Calculating a Recording Time

The total **Record Time** available depends upon the amount of available memory. The unit checks your setup to determine the amount of available memory. If there is not enough memory, a warning message appears and the **Record Time** defaults to the maximum available. For approximate record times, refer to the table below:

Follow these steps to set the **Record Time** parameters:

(1) Press the **Setup** key to access the **Main Menu**.

(2) Press the **Down Arrow** key until **View/Edit Setup** is highlighted. Press the **Enter** key to access this menu selection.

(3) Within the **Edit Current Setup** menu, press the **Down Arrow** key until the **Record Time** menu option is highlighted.

(4) Press the **Right Arrow** key to access this menu selection.

(5) The first selection is **Record Stop Mode**.

(6) Press the **Right Arrow** key to toggle between **Auto Record** or **Fixed Time**.

(7) Press the **Enter** key to **Save** the changes.

(8) Use the **Down Arrow** keys to highlight **Record Time**.

(9) Press the **Right Arrow** key to access the value field.

(10) Press the **Up** or **Down Arrow** key to change the values within **Record Time**.

(11) Press the **Enter** key to **Save** the changes.

(12) Press the **Down Arrow** key to access the **Auto Window** setting.

(13) Press the **Right Arrow** key to access the value field.

(14) Press the **Up** or **Down Arrow** key to change the values within the **Auto Window** field.

(15) Press the **Enter** key to **Save** the changes, or the **Cancel** key to return to the previous menu without saving the changes.

NOTE: Approximate Monitor Record Times are listed below for each **Channel** and associated **Sample Rate**:

Approximate Monitor Recording Times Displayed in Seconds					
Sample Rate	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**	**Channel 6**
512	211296	105648	70432	52824	35216
1024	105648	52824	35216	26412	17608
2048	52824	26412	17608	13206	8804
4096	26412	13206	8804	6603	4402
Approximate Monitor Recording Times Displayed in Hours					
Sample Rate	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**	**Channel 6**
512	58.7	29.3	19.6	14.7	9.8
1024	29.3	14.7	9.8	7.3	4.9
2048	14.7	7.3	4.9	3.7	2.4
4096	7.3	3.7	2.4	1.8	1.2

h. Monitor Scheduler

The **Monitor Scheduler** feature sets the **Minimate Pro** unit to automatically start monitoring sessions at a preset time using a series of setup files and, if required, the **Self Check** feature can be activated. The scheduler can be set for a one time session, daily, or weekly and repeated. Using the **Monitor Scheduler** extends the battery life by only monitoring the time periods when Events are scheduled to occur and not the time periods between Events. It allows for different monitoring **Record Modes** to be selected, too, as long as the sensors remain the same within each setup file used.

The settings for **Monitor Scheduler** are completed within the **Blastware Compliance Setup** menu and sent to the unit. Please refer to the **Blastware Operator Manual** for more information on the **Monitor Scheduler** feature.

Ensure that the **Monitor Scheduler** is **On**, by activating it within **Blastware > Unit > Monitor**, or on the monitor under **View/Edit Setup > Monitor Scheduler > On** with a key press of **Start Monitoring**. This feature can also be turned **Off** at these menu locations.

Once you have setup and started monitoring, you can stop recording at any time by pressing the **Cancel** key on the unit or **Stop Monitoring** from within the **Blastware** software.

(1) Press the **Setup** key.

(2) Press the **Down Arrow** key until **View/Edit Setup File** is highlighted.

(3) Press the **Down Arrow** key until **Monitor Scheduler** is highlighted.

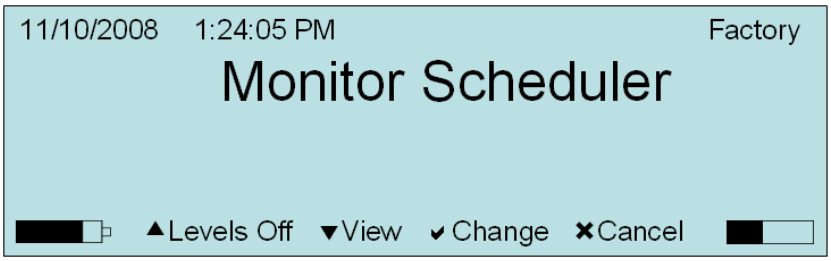
(4) Press the **Right Arrow** key to toggle between **On** or **Off**.

(5) Press the **Enter** key to **Save** the setting.

(6) Press the **Enter** key to **Accept** the **Save Setup File** prompt, or use the **Up** and **Down Arrow** keys to change the name of the **Setup File** before saving.

(7) Send a **Monitor Scheduler** setup from **Blastware**. **Refer to the Blastware Operator Manual** on how to setup and send a series of scheduled monitoring sessions.

(8) Start the Monitor Scheduler session by activating it within **Blastware > Unit > Monitor**, or on the monitor with a key press of **Start Monitoring**. It will appear as it does below until the first scheduled setup file is started, after which it will display the current monitor mode (e.g. **Waveform**, **Histogram**, or **Histogram Combo**):



i. Auxiliary I/O

The **Auxiliary I/O** menu controls the triggering of an optional **Remote Alarm** (Part No. 711A1401) based on levels set for **Vibration** or **Pressure**, or for an **External Trigger**, using the optional **Wire Break/Make Trigger Cable** (Part No. 720A3501). Refer to the **Optional Features** section of this manual for more information.

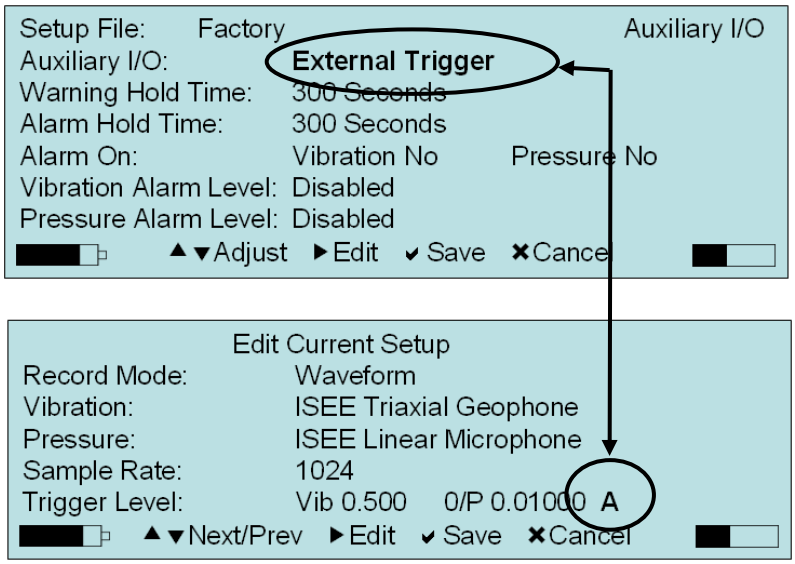
The **Remote Alarm** sounds two alarms: **Warning** and **Alarm**. The warning alarm sounds when Event activity exceeds the **Vibration Trigger Level** or **Pressure Trigger Level**. The **Vibration Alarm Level** and /or the **Pressure Alarm Level** can be set to a higher level than the **Geophone Trigger Level** and the **Pressure Trigger Level**. This allows for the triggering of a second alarm at the higher level.

For example, in pile driving operations the remote alarm triggers a warning when activity exceeds the trigger level for the geophone, notifying the operator that the pile driving activity has exceeded the set level. The second alarm triggers when activity exceeds the **Vibration Alarm Level**, set to a higher level, notifying the operator that operations should cease immediately.

IMPORTANT: The **Remote Alarm** is not active until the **Start Monitor** key is pressed on the unit.

The optional **Remote Alarm** and **Wire Break/Make Trigger Cable** are shipped with instruction sheets.

When **External Trigger** is selected, the **Trigger Level** menu item will automatically reflect the change by placing an "A" after the sensor and threshold you want to trigger the recording, as shown below:


Setup File: Factory
Auxiliary I/O
Auxiliary I/O: External Trigger
Warning Hold Time: 300 Seconds
Alarm Hold Time: 300 Seconds
Alarm On: Vibration No Pressure No
Vibration Alarm Level: Disabled
Pressure Alarm Level: Disabled
▲▼Adjust ▶Edit ✔Save ✖Cancel
Edit Current Setup
Record Mode: Waveform
Vibration: ISEE Triaxial Geophone
Pressure: ISEE Linear Microphone
Sample Rate: 1024
Trigger Level: Vib 0.500 0/P 0.01000 A
▲▼Next/Prev ▶Edit ✔Save ✖Cancel

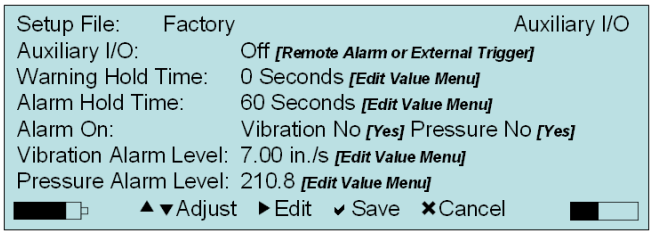
Follow the directions below to set the **Alarm Levels** within the **Auxiliary I/O** menu**:**

(1) From the **Main Display**, press the **Setup** key to access the **Main Menu**.

(2) Press the **Down Arrow** key on the unit to highlight the **View/Edit Current Setup** menu option.

(3) Press the **Down Arrow** key until the **Auxiliary I/O Levels** menu option is highlighted.

(4) Press the **Right Arrow** key to access the **Auxiliary I/O** menu, as shown below:


Setup File: Factory
Auxiliary I/O
Auxiliary I/O: Off [Remote Alarm or External Trigger]
Warning Hold Time: 0 Seconds [Edit Value Menu]
Alarm Hold Time: 60 Seconds [Edit Value Menu]
Alarm On: Vibration No [Yes] Pressure No [Yes]
Vibration Alarm Level: 7.00 in./s [Edit Value Menu]
Pressure Alarm Level: 210.8 [Edit Value Menu]
▲▼Adjust ▶Edit ✔Save ✖Cancel

(5) To set the **Auxiliary I/O** feature, use the **Down Arrow** key to highlight the option, and then the **Right Arrow** key to toggle the feature between **Off**, **Remote Alarm**, or **External Trigger**.

(6) Determine how long you want the **Warning Alarm** and **Alarm Hold Time** to sound, and enter a value in the field to the right of these features by using the **Right Arrow** key to access the value editing field. Press the **Up** or **Down Arrow** key to change the value in each field. Jump between the fields by using the **Right** or **Left Arrow** keys. Press the **Enter** key to **Save** the edits to each selection. The **Warning Alarm** and **Alarm Hold Time** have a 300 second time limit (5 minutes). If it is set to "**0**" then the user will need to manually press the **Enter** key.

(7) Highlight the **Alarm On** option and press the **Right Arrow** key to change the options for which sensor(s) you want to trigger the alarm. Each key press will provide a new setting option, as follows:

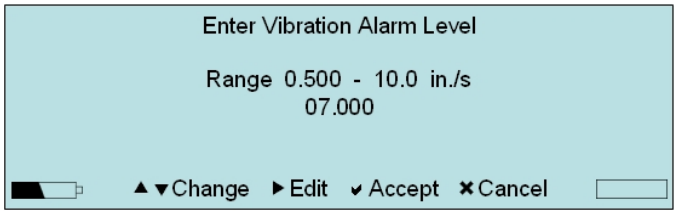
Minimate Pro4 or **Minimate Pro6 with a Microphone and a Geophone:**

Vibration	No	Pressure	No
Vibration	Yes	Pressure	Yes
Vibration	No	Pressure	Yes
Vibration	Yes	Pressure	No

Minimate Pro6 with two Geophones:

Vibration	No	Vibration 2	No
Vibration	Yes	Vibration 2	Yes
Vibration	No	Vibration 2	Yes
Vibration	Yes	Vibration 2	No

(8) To set the **Vibration Level** value, use the **Down Arrow** key to highlight the option, and then the **Right Arrow** key to enter the edit menu, as shown below:

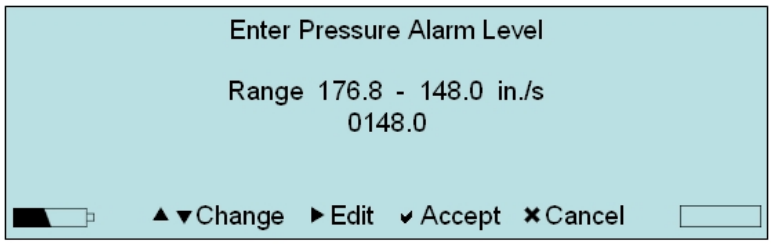


NOTE: If you are using a **Minimate Pro6** monitor with two geophones attached, than there are two options to set the **Vibration Alarm Level** for each geophone attached, **Vibration 1 Level** or **Vibration 2 Level**.

(9) Press the **Right Arrow** key to move the cursor within the value field, and the **Up** or **Down Arrow** key to **Change** the value setting.

(10) Press the **Enter** key to **Accept** the new setting, or the **Cancel** key to exit the menu without saving the changes.

(11) To set the **Vibration Level** value, use the **Down Arrow** key to highlight the option, and then the **Right Arrow** key to enter the edit menu, as shown below:



NOTE: If you are using a **Minimate Pro6** monitor with a geophone and a microphone attached, than there are options to edit the levels for both sensors.

(12) Press the **Right Arrow** key to move the cursor within the value field, and the **Up** or **Down Arrow** key to **Change** the value setting.

(13) Press the **Enter** key to **Accept** the new setting, or the **Cancel** key to exit the menu without saving the changes.

(14) Within the **Edit Current Setup** menu, press the **Enter** key to **Save** the new **Auxiliary I/O** settings, or the **Cancel** key to exit the menu without saving the changes.

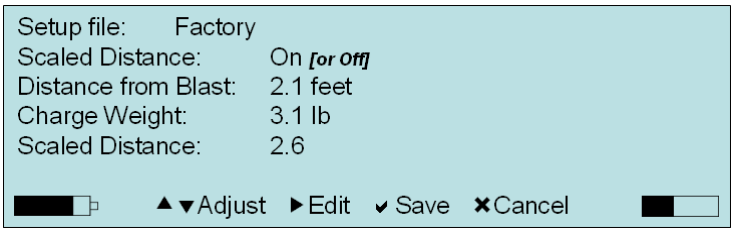
(15) Press the **Enter** key two more times to **Save** the new settings as a **Setup File**.

j. Scaled Distance:

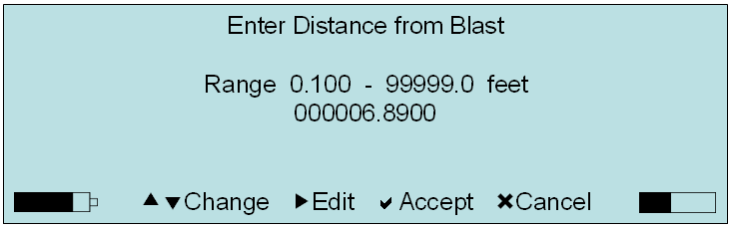
Scaled Distance represents the division of distances by a scaling factor of the **Charge Weight** allowing the comparison between blasts of different sizes. The end-function is to predict **Peak Particle Velocities** (**PPV**) when the energy released is a variable. Turn the **Scaled Distance** feature **On** to include the input and calculated **Scaled Distance** information with each **Event Summary Report.**

This information can then be used in conjunction with the **Blastware** software **Scale Distance Graph** tool which also invokes the **Max Weight Table** dialog tool that calculates a range of **Charge Weights** at different distances, based on a user-specified **PPV**. This provides a range of calculations enabling the user to obtain precise information for the blast site with a 95% confidence level. The **Scaled Distance** tool calculates the maximum **Charge Weight** per delay and the minimum safe structure distance for a specific blast site. The information is presented in a regression **Line Graph** represented by **Square Root**, **Cube Root**, or **Air Blast** calculations.

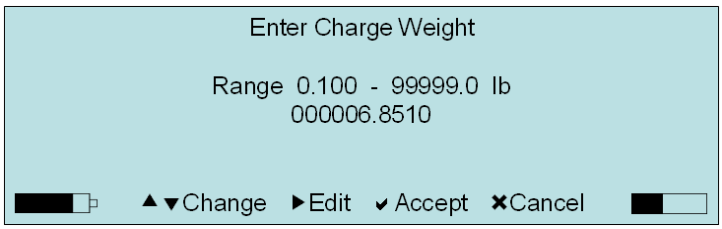
Enter the **Distance** from the blast and the **Charge Weight**. The **Distance** from blast factor is the measured distance from the blast charge to the monitors sensors. The **Charge Weight** is the physical weight of the charge used per delay. The unit automatically calculates and displays the **Scaled Distance** value. The value will appear within the **Event Summary Reports** and can be used within the **Blastware Scaled Distance Graph** tool if the option is turned **On**.


Setup file: Factory
Scaled Distance: On [or Off]
Distance from Blast: 2.1 feet
Charge Weight: 3.1 lb
Scaled Distance: 2.6
▲▼Adjust ▶Edit ✔Save ✖Cancel

(1) Press the **Up** or **Down Arrow** keys to highlight the **Scaled Distance** setting. It will be listed as being **On - Edit** or **Off - Edit**. Press the **Right Arrow** key to access the **Scaled Distance** menu.
(2) Press the **Right Arrow** key to toggle the **Scaled Distance** option **On** or **Off**.
(3) If you have decided to use the **Scaled Distance** feature, press the **Down Arrow** key to highlight the **Distance from Blast** option. Press the **Right Arrow** key to edit this field.



(4) Press the **Right** and **Left Arrow** keys to navigate through the **Range** values.
(5) Press the **Up** and/or **Down Arrow** keys to change the values within the **Enter Charge Weight** value menu.
(6) Select **Enter** to **Accept** the specified value.



(7) Next, within the **Scaled Distance** menu, press the **Down Arrow** key until the **Charge Weight** option has been highlighted. Press the **Right Arrow** key to edit this field.
(8) Press the **Right** and **Left Arrow** keys to navigate through the **Range** values.
(9) Press the **Up** and/or **Down Arrow** keys to change the values within the **Enter Charge Weight** value menu.
(10) Press the **Enter** key to **Accept** the specified value.
(11) Press the **Enter** key to **Save** the changes and return to the **Edit Current Setup** menu.

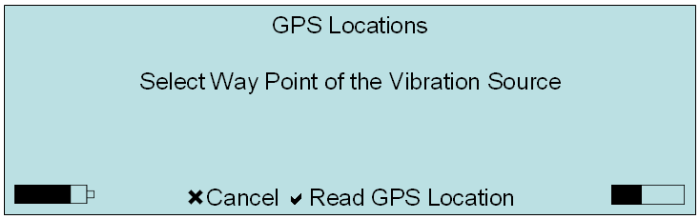
k. GPS Location

Use the **GPS (Global Positioning System) Location** feature to enter location information of the sensor and unit, relative to the blast and have them displayed on your **Event Reports**. GPS devices locate your exact longitude and latitude from orbiting satellites.

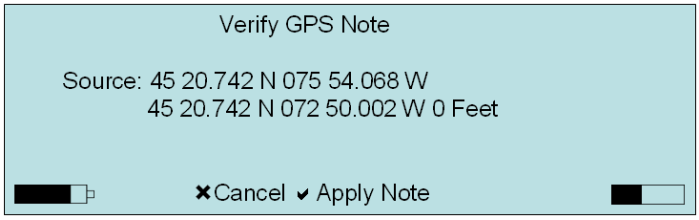
For accuracy and synchronization of several units, the unit time can also be set with the GPS device. This UTC (Coordinated Universal Time) time is created from the mean solar time at the Royal Observatory, Greenwich – refer to the **Date and Time** section under **View/Edit Preferences**, for more information on setting the time with a GPS device. To use this feature of the unit, a NMEA 4800 standards compatible and

supported GPS unit is required. Instantel has tested and recommends the Garmin® eTrex®.

(1) Ensure that you have read the manufacturers instructions that came with your GPS device unit prior to proceeding.
(2) Collect the waypoint information for the **Vibration Source** and **Sensor(s)**.
(3) Attach the GPS device to the connector on the unit labeled **Auxiliary** by using the supplied **RS-232** cable.
(4) Press the **Setup** key.
(5) Press the **Up** or **Down Arrow** keys on the unit to highlight **View/Edit Setup File** and then press **Enter**.
(6) Press the **Up** or **Down Arrow** keys on the unit to highlight **GPS Location** and then press the **Right Arrow** key.
(7) Within the **GPS Locations** menu, the unit prompts to **Select Way Point of the Vibration Source**. Select **Read GPS Location** by pressing the **Enter** key, or the **Cancel** key to return to the previous screen.



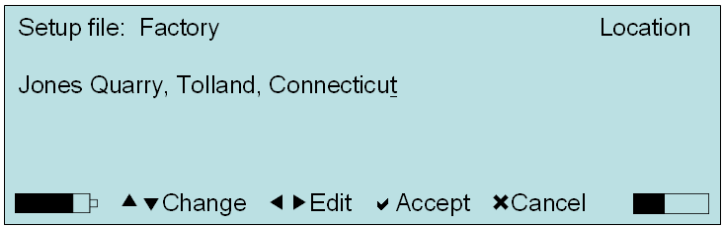
(8) The unit briefly displays **Reading Location from GPS**.
(9) The unit than prompts, **Select Way Point of [Sensor Name]**. Select **Read GPS Location** by pressing the **Enter** key, or the **Cancel** key to return to the previous screen. This step will be repeated if two sensors are attached to the unit.
(10) After entering all GPS locations, the unit will display the results and request **Verify GPS Note**. An example screen is shown below, using one sensor:



(11) Press the **Enter** key to **Save** the file, or the **Cancel** key to return to the previous screen.

I. Location:

Use this command to link a specific **Location** to the monitored Events. The information input into the **Location** will appear on the **Event Report** created in **Blastware**, under the **Notes** section, and displayed in the **Event Manager**. Select **Location** from the **Edit Current Setup** menu by pressing the **Right Arrow** key.

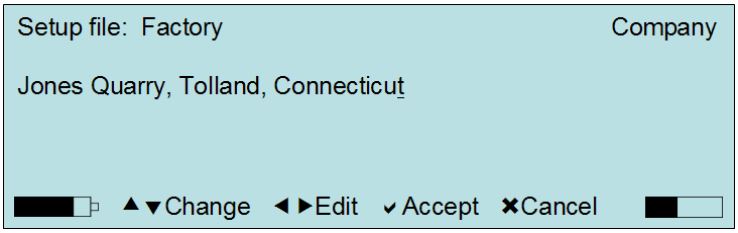


(1) Press the **Up** or **Down Arrow** keys on the unit to highlight and **Change** the **Setup File**.
(2) Press the **Right Arrow** key to select the file to **Edit**.

(3) If you are editing the **Setup File**, then press the **Right** and **Left Arrow** key to move from each character field.
(4) Press the **Up** or **Down Arrow** keys to change the character of each field. You are able to enter up to 40 characters.
(5) Press the **Enter** key to **Save** the file, or the **Cancel** key to return to the previous screen.

m. Company:

Use this command to link a specific **Company** to the monitored Events. The information input into the **Company** will appear on the **Event Report** created in **Blastware**, under the **Notes** section. Select **Company** from the **Edit Current Setup** menu by pressing the **Right Arrow** key.

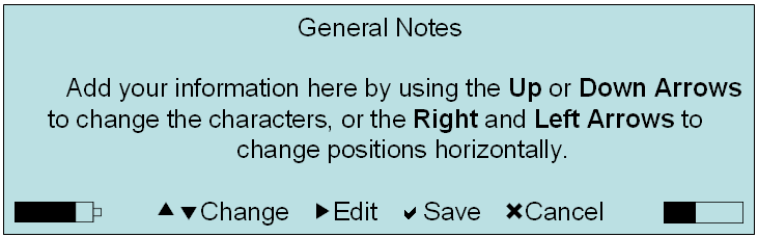


(1) Press the **Up** or **Down Arrow** keys on the unit to highlight and **Change** the **Setup File**.
(2) Press the **Right Arrow** key to select the file to **Edit**.
(3) If you are editing the **Setup File**, then press the **Right** and **Left Arrow** key to move from each character field.
(4) Press the **Up** or **Down Arrow** keys to change the character of each field. You are able to enter up to 40 characters.
(5) Press the **Enter** key to **Save** the file, or the **Cancel** key to return to the previous screen.

n. General Notes:

The **General Notes** feature lets you include notes describing an Event. You can input the notes using the **Blastware** software and then copy them to the **Minimate Pro** or you can input the notes directly into the **General Notes** menu of the monitor. Use this menu to edit existing notes or add new notes. The information input into the **General Notes** will appear on the **Event Report** created in **Blastware**, under the **Notes** section.

Select **General Notes** from the **Edit Current Setup** menu.


General Notes
Add your information here by using the Up or Down Arrows to change the characters, or the Right and Left Arrows to change positions horizontally.
▲▼Change
►Edit
✔Save
✖Cancel

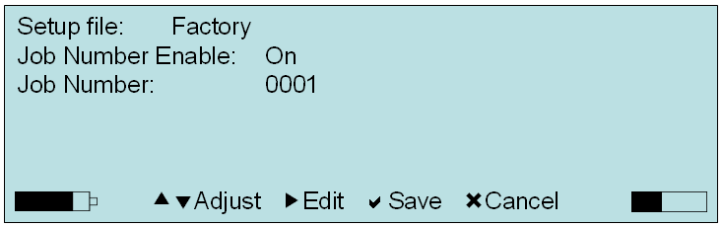
(1) Press the **Up** or **Down Arrow** keys on the unit to highlight and **Edit** the **General Notes**.
(2) If you are editing the **General Notes**, then press the **Right** and **Left Arrow** key to move from each character field.
(3) Press the **Up** or **Down Arrow** keys to change the character of each field. You are able to enter up to 40 characters.
(4) Press the **Enter** key to **Save**, or the **Cancel** key to return to the previous screen.

o. Job Number:

You may include a **Job Number** for each recorded Event. Job numbers help you keep track of Events stored in the **Minimate Pro** or in the **Event Report**, under the **Notes**

section. Job numbers range from 1 to 9999 and start with the initial number input in this menu.

Select **Job Number** from the **Edit Current Setup** menu. The information input into the

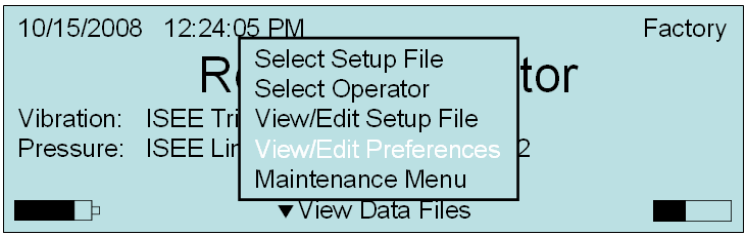


(1) Press the **Up** or **Down Arrow** keys on the unit to highlight **Job Number**.
(2) Press the **Right Arrow** key to access the menu.
(3) Press the **Right Arrow** key to toggle **Job Number Enable** to **On** or **Off**.
(4) Press the **Down Arrow** key to highlight the **Job Number** selection.
(5) Press the **Right Arrow** key to enter the value field
(6) Use the **Up** or **Down** arrow keys to edit the value field.
(7) Press the **Enter** key to **Save** the file, or the **Cancel** key to return to the previous screen.

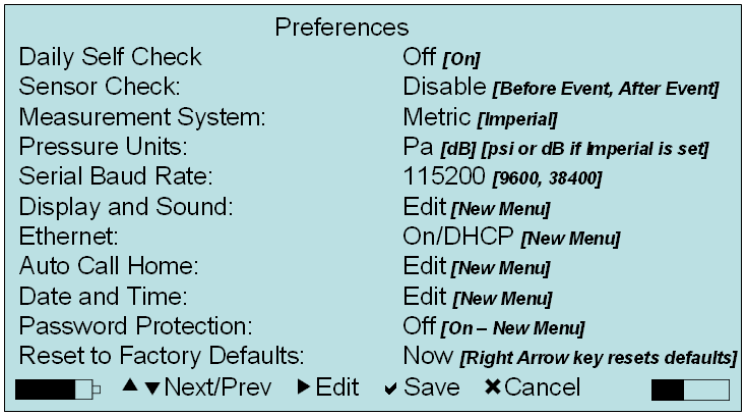
9.5. View/Edit Preferences

The **View/Edit Preferences** menu allows you to configure how the monitor communicates with the **Blastware** software, and how the interface is setup, such as the units used (imperial or metric), and display and sound options. These options are setup and saved, but not to a specific file. The monitor continues to operate with the current settings until the next change is made. This section outlines the procedures to change the preferences using the **Minimate Pro** keyboard. For information on how to change the preferences using a personal computer and **Blastware**, refer to the **Blastware Operator Manual**.

1. Select the **Setup** key on the unit to access the main setup selection menu. Use **Down Arrow** key and highlight the **View/Edit Preferences** menu item. Press the **Enter** key to select **View/Edit Preferences**.



2. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev Setup** options. Press the **Right Arrow** key to select a **Preferences** option for toggling, editing or viewing. Press the **Enter** key to **Save** any changes, or the **Cancel** key to return to the previous screen. The image below indicates in "***[…]***" the result of a **Right Arrow** key selection:



a. Sensor Check:

Use the **Sensor Check** feature to determine if the attached sensors are connected, oriented, and working properly, or to ensure that the sensors match the current settings within the **View/Edit Setup File** menu if it has been set to **Before** or **After** an Event. The results of the **Sensor Check** and the associated information for each sensor, including **Serial Number**, **Calibration Date**, and **Calibration Location**, appear on the **Event Report**.

A **Sensor Check** may be setup to occur automatically, or by manual key-press:

(1) Repeatedly press the **Right Arrow** key to set when a **Sensor Check** will occur, **After Event** or **Before Event**. You can also select **Disable**. If you select **Disable**, a **Sensor Check** can still be performed manually by pressing the **Sensor Check** key on the monitor. The manual **Sensor Check** is only allowed when the unit is not in monitor mode.

If **Sensor Check** is set **Before Event**, the check is performed once and added to all subsequent Event data. If the **Sensor Check** is set to **After Event**, then the **Sensor Check** is performed after each Event and added to each Events data.

(2) Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **Preferences** menu, or

(3) Press the **Sensor Check** key to perform a manual check while at the main menu.

NOTE: The **Sensor Check** is not a calibration check and cannot replace the annual calibration process. **Sensor Check** does not compare the measured result against an external traceable reference sensor, nor does it test the entire electronic circuit that is integral to the sensors response.

NOTE: The sensors selected within the **Edit Current Setup** menu should match what is attached to the unit.

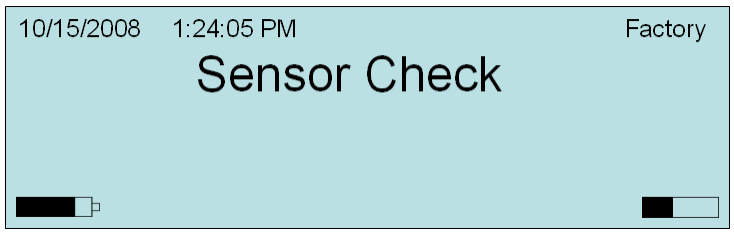
Example: If the **Pressure Sensor** Channel is **Off** and a **Linear Microphone** is attached, or if it is **On**, and a **Linear Microphone** is not attached, the **Sensor Check** will return the message, "*Sensor Detection Error – Attached Sensors do not match setup*".

When a **Sensor Check** error occurs, check the following for possible causes:

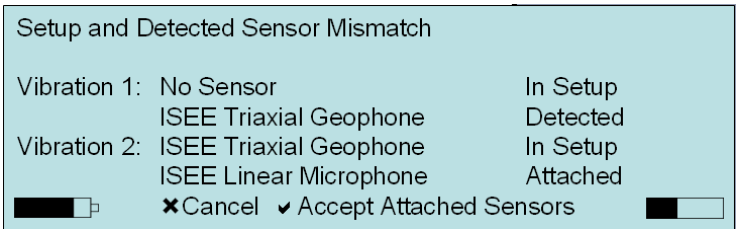
- Was the sensor moved during the **Sensor Check**? This will result in a failed reading.
- Ensure that the orientation of the Geophone is correct, as per the given application, such as a ceiling installation. Refer to the section in this manual, *Geophone Direct Hard Surface Mount Installation Instruction.*

- Check all cable connections.
- Check cables and connectors for wear, bent pins, or foreign debris.
- If required, return the sensor to an **Authorized Instantel Representative** for further testing.

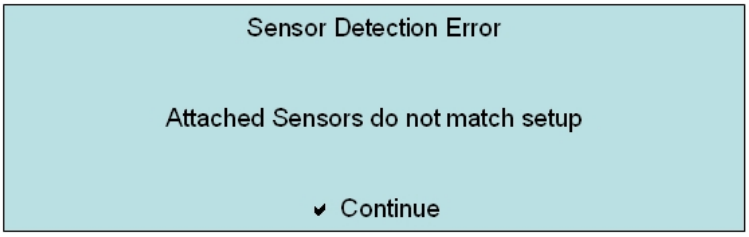
Example 1:
An example of a **Sensor Check** set to **Before Monitoring** on a **Minimate Pro6** that did not pass is shown below:



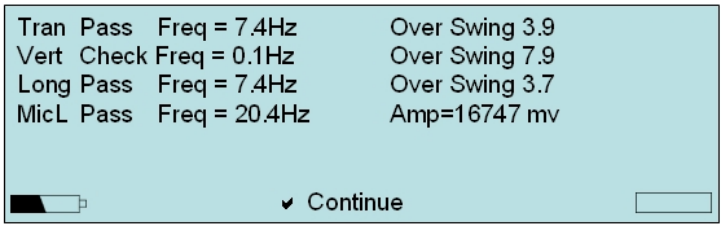
The next screen displays the **Setup and Detected Sensor Mismatch** message when trying to record using sensors that do not match the **Setup File**. Note that the **Vibration 1** channel displays **No Sensor In Setup**, but the message below it states that and **ISEE Triaxial Geophone** has been **Detected**.


Setup and Detected Sensor Mismatch
Vibration 1: No Sensor In Setup
ISEE Triaxial Geophone Detected
Vibration 2: ISEE Triaxial Geophone In Setup
ISEE Linear Microphone Attached
✖Cancel ✔Accept Attached Sensors

Press the **Enter key** to **Accept** the setup as shown and proceed to monitor, or press the **Cancel** key to exit and edit the **Setup** file.



Example 2:
Even though you have accepted to ignore the **Setup and Sensor Mismatch** warning, an additional screen is displayed indicating that there is an additional error with the orientation of the Geophone; the **Vert** (Vertical) channel states "***Check***" indicating that the sensor has been incorrectly positioned upside down or is not working properly:


Tran Pass Freq = 7.4Hz Over Swing 3.9
Vert Check Freq = 0.1Hz Over Swing 7.9
Long Pass Freq = 7.4Hz Over Swing 3.7
MicL Pass Freq = 20.4Hz Amp=16747 mv
✔ Continue

(1)1. Sensor Check Overview – Geophones

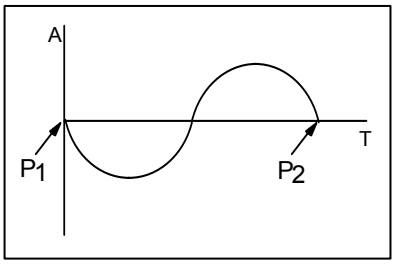
Sensor Check measures a geophone's natural frequency and damping indicated by an Overswing Ratio (OR). **Sensor Check** sends an electric pulse to the

geophones and measures the response. If the geophone's response falls within a specified range, the monitoring operations can continue. If the geophone's response does not fall within a specified calibration range, the geophone is not setup or functioning properly. You cannot record Events until you fix or replace the geophones.

Natural Frequency

Waveform measurements check the natural frequency (or period [t]) of a geophone's sensor coil assembly. Referring to the figure below, the distance from P_1 to P_2 represents 0.125 seconds. Since Frequency is the reciprocal of the period, F=1/t, the frequency is approximately 8 Hz. A calibrated sensor has a natural frequency between 6.5 and 9.5 Hertz. Calculations for all geophones appear with each recorded Event.

Calculating the Natural Frequency of a Geophone



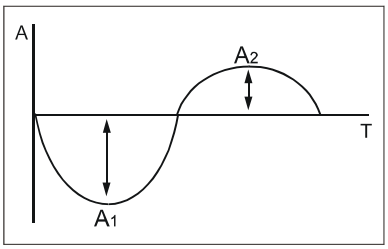
Damping – Overswing Ratio (OR)

The OR measures damping and is calculated by computing the ratio of the magnitude of adjacent waveform peaks according to the following formula:

$$OR = \frac{A_1}{A_2}$$

Acceptable OR ranges from 2.8 to 4.8. The figure below displays a graph of a geophone coil's "free fall" response. A_1 and A_2 are used for OR calculations.

Calculating the Overswing Ratio of a Geophone



(1)2. Sensor Check Overview – Microphones

Sensor Check tests the microphone operation by sending a signal to the microphone and measuring its frequency and amplitude response. If the results of the test fall within specified ranges, the microphone is within calibration.

b. Measurement System:

The unit uses the **Metric** or the **Imperial** measurement system. **Event Reports** and displayed results will be shown in the selected units. To set the unit to operate with either system, follow the directions below.

(1) Press the **Right Arrow** key to set the **Measurement System** to **Metric** or **Imperial**. All system responses and **Event Reports** involving measurement values will be displayed in the selected Measurement System.

(2) Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **Preference**s menu.

c. Pressure Units:

Determine the **Pressure Units** that you would like to display on the monitor and **Event Reports** for the **Linear Microphone Pressure Channel**. The options are **Pa**, **psi**, or **dB**, and the availability of these is dependent on the setting you have selected for the **Measurement System**, **Imperial** or **Metric**. **Pa** is not available when the **Measurement System** is set to **Imperial**.

(1) To set the **Pressure Unit**, press the **Right Arrow** key to access the unit field.

(2) Press the **Up** or **Down Arrow** keys to change the unit value, which is dependent on the selected **Measurement System**.

(3) Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **Preferences** menu.

d. Serial Baud Rate:

The **Serial Baud Rate** refers to the rate at which both the PC and the monitor will communicate. The baud rate of the unit and the **Blastware** software, located within the **Unit –> Communications** menu, must be the same for a successful communication link.

(1) Within the **Preferences** menu of the **Minimate Pro**, press the **Right Arrow** key to access the **Serial Baud Rate** field.

(2) Continue to press the **Right Arrow** key to cycle through the communication speed options of **115200**, **38400**, or **9600** – ensure that it matches with the **Blastware** software setting, or you will not be able to communicate with the unit using your PC. The lower the number, the slower the rate of communications and file transfer.

(3) Press **Enter** key to **Save** any changes.

e. Display and Sound:

Use the options within the **Display and Sound** menu to determine how the unit reacts to your key entries. You can also control the amount of battery consumption by reducing the time the LCD backlight is on.

From the main menu, press the **Setup > View/Edit Preferences > Display and Sound** to access the following features:

(1) Beep on Trigger:

Turn this feature **On** and the monitor will emit a beeping sound each time it is triggered to record an Event.

1. Ensure that **Beep On Trigger** is highlighted.
2. To set the unit to beep **On** or **Off**, press the **Right Arrow** key to toggle between the two options.
3. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **View/Edit Preferences** menu.

(2) Beep on Key Press:

With this feature **On** the monitor will emit a beeping sound at each key press.

4. Use the **Down Arrow** key to highlight **Beep on Key Press**.
5. To set the unit to beep **On** or **Off**, press the **Right Arrow** key to toggle between the two options.

6. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **View/Edit Preferences** menu.

(3) Backlight:

Use this feature to either help conserve power, by turning it **Off**, or turn it **On** to provide a better view of the information in low-light conditions.

1. Use the **Down Arrow** key to highlight **Backlight**.
2. To set the unit **Backlight** option, press the **Right Arrow** key to edit the time value.
3. Press the **Right** or **Left Arrow** keys to move between value fields.
4. Press the **Up** or **Down Arrow** keys to edit each field.
5. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **View/Edit Preferences** menu.

(4) Backlight Timeout:

For battery conservation, the unit **Backlight Timeout** feature can be used to set the backlight to turn off after a designated amount of time.

1. Use the **Down Arrow** key to highlight **Backlight Timeout**.
2. To set the time value for the **Backlight Timeout**, press the **Right Arrow** key to access the value fields.
3. Press the **Right** or **Left Arrow** keys to navigate within value field.
4. Press the **Up** or **Down Arrow** keys to change the value. The maximum setting is 999.
5. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **View/Edit Preferences** menu.

(5) Display Auto Off:

For battery conservation, the **Display Auto Off** feature must be set to **Enabled** to ensure that the LCD display will turn off after 2 minutes of no entries on the unit. If it is **Disabled**, the LCD display will remain on.

1. Use the **Down Arrow** key to highlight **Display Auto Off**.
2. Press the **Right Arrow** key to access this feature.
3. Press the **Right Arrow** key to change between **Enabled** and **Disabled**.
4. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **View/Edit Preferences** menu.

(6) Display Colour Levels:

Using three primary colors **Red**, **Green** and **Blue** (**RGB**), you can alter the color of the display backlight by balancing the amount of each color value. The maximum range of each color is 15. Experiment with each color value to determine which color is most suitable.

5. Use the **Down Arrow** key to highlight **Display Color Levels**.
6. Press the **Right Arrow** key to access this feature.
7. Press the **Up** or **Down Arrow** key to select which color you want to edit.
8. Press the **Right Arrow** key to edit the first value, and again to edit the second value.
9. Press the **Up** or **Down Arrow** keys to edit the values.
10. Press **Enter** to **Save** the changes.
11. Press **Enter** to return to the **Display and Sound** menu, or **Cancel** to return to the menu without saving the changes.

(7) Display Contrast Level:

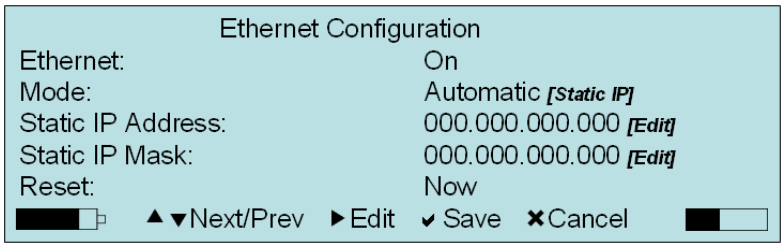
Using three primary colors **Red**, **Green** and **Blue** (**RGB**), you can alter the color of the display backlight by balancing the amount of each color value. The maximum range of each color is 15. Experiment to determine which color is most suitable for the current lighting situation.

12. Use the **Down Arrow** key to highlight **Display Contrast Levels**.

13. Press the **Right Arrow** key to access this feature.
14. Press the **Up** or **Down Arrow** key to change the value. The smaller the number, the lighter the display. The allowable contrast range is from 12 to 40.
15. Press **Enter** to **Save** the changes.
16. Press **Enter** to return to the **Display and Sound** menu, or **Cancel** to return to the menu without saving the changes.

f. Ethernet:

Ethernet® is a high-speed network communication protocol standard that is primarily used for Local Area Networks (LAN) to connect end-systems, in this instance, the **Series IV** units to a network. The **Series IV** units have the ability to communicate using an **Ethernet** connection, and this option is available with the purchase of an **Ethernet Communication Cable**, **Minimate Pro to PC** (Part No. 720A4101). One cable for each unit is required when setting up multiple units on a router.



This communication includes downloading recorded **Event**s and uploading setup files to the unit at a much faster rate than serial or USB, and with the optional **Blastware Advanced Module**, the ability to view **Histogram** data in real-time.

Refer to the **Blastware Operator Manual** for additional information about setting up the **Ethernet** communications feature, and the common terminology used, below:

LAN – Local Area Network	A LAN is a communications system that links computers and/or devices (Printers, Monitors, Servers, etc.) within a confined geographic area, such as a home or office building.
WAN – Wide Area Network	A WAN is a communications system that links computers and/or devices within a larger network, such as between cities or different building locations.
TCP/IP – Transmission Control Protocol/Internet Protocol	TCP/IP is the backbone communication language of the internet or intranet.
DNS – Domain Name Server	DNS hosts domain names and acts as the 'phone book' for the Internet by creating IP Addresses from domain names. DNS routes all queries for your domain to your server.
IP Address – Internet Protocol	The IP Address is a unique address assigned for devices to communicate with one another over a computer network.
DHCP - Dynamic Host Configuration Protocol	DHCP is where a device (such as your PC) on a local network, known as a DHCP Server, assigns temporary addresses to attached devices.
DHCP/Auto IP Address	If the program is not able to create a DHCP address, then Auto IP is used.
Auto(matic) IP Address	The Auto IP Address is a communications protocol that allows devices at either end of a network segment to advertise and negotiate operation (e.g. link speed, data flow control), by assigning an IP Address. This is done by ensuring that the TCP/IP protocol is

	installed and set to obtain the IP Address automatically from the DHCP server.
Static IP Address	A set (non-dynamic) IP address. If you have a Static IP Address, it is recorded in the DNS (Domain Name Server), which are servers located throughout the Internet that handle the routing of Internet and email. A Static IP Address remains unchanged, even when rebooting your PC or Router. Obtain your Static IP from a local Internet Service Provider.
Static IP Mask	Static IP Masks are used to separate IP networks into subgroups. Obtain your Static IP Mask from a local Internet Service Provider.
Router	A Router is a device that acts as a gateway, controlling messaging for communication and access to network resources, between a LAN and a WAN.

(1) Ethernet:

Turn this feature **On** or **Off** by following the directions below:

1. Press the **Up** or **Down Arrow** key to highlight **Ethernet**.
2. Press the **Right Arrow** key to access the **Ethernet** menu.
3. Press the **Right Arrow** key to toggle between **On** and **Off**.
4. Press the **Enter** key to save this setting.

(2) Mode:

There are two **IP Address** modes to choose from to establish communications, a) **Automatic IP**, and b) **Static IP**. With the **Automatic IP** setting, the computer will assign the address to your **Minimate Pro**. For **Static IP**, you must purchase an **IP Address** from an Internet Service Provider, which usually involves a nominal monthly payment, and then enter the number into the **Static IP Address** section.

1. Press the **Down Arrow** key to highlight **Mode**.
2. Press the **Right Arrow** key to toggle between **Automatic** or **Static IP**. Select the **Mode** of communication you want to use.
3. Press the **Enter** key to save this selection.

(3) Static IP Address:

After you have purchased a **Static IP** from an Internet Service Provider, enter the number in the **Static IP Address** field. The first 3 sets of numbers, divided by periods (Example: **192**.**196**.**001**.001), of the **Static IP** must match and be input into the PC TCP/IP network setting for the Ethernet hardware, with the last number altered (Example: 192.168.001.**002**). The **Static IP** address ***must match exactly*** within the **Blastware Communications** dialog. Refer to the **Blastware Operator Manual** for more detailed information on setting up the **Static IP**.

4. Press the **Down Arrow** key to highlight **Static IP Address**.
5. Press the **Right Arrow** key to enter the editing mode.
6. Press the **Right** and **Left Arrow** keys, as required, to place the cursor under the desired numeral.
7. Press the **Up** or **Down Arrow** keys to edit each field.
8. Press the **Enter** key to save the new setting.

(4) Static IP Mask:

After you have purchased a **Static IP** from an Internet Service Provider, enter the supplied **Static IP Mask** number into the field, if applicable. LANs typically use the 255.255.255.0 **Static IP Mask**.

1. Press the **Down Arrow** key to highlight **Static IP Mask**.
2. Press the **Right Arrow** key to enter the editing mode.

3. Press the **Right** and **Left Arrow** keys, as required, to place the cursor under the desired numeral.
4. Press the **Up** or **Down Arrow** keys to edit each field.
5. Press the **Enter** key to save the new setting.

(5) Reset:

Use the **Reset** command to return all **Ethernet** settings to the factory default. This command also assigns a new **Auto IP Address** to the unit.

1. Press the **Down Arrow** key to highlight **Reset**.
2. Press the **Right Arrow** key to activate the **Reset** command. You will notice that the **Static IP** and **Static IP Mask**, if previously changed, will default to the original settings. Additionally, within **Blastware**, under **Unit** > **Communications** > **Ethernet** > **Test**, the **TCP/IP Discovery** window will display a new **IP Address** for the unit if you are communicating using the **Automatic IP** protocol..

g. Auto Call Home™

Combined with the **Auto Call Home** feature of **Blastware**, your monitor can be setup to automatically download results either after an Event, or at specified times. You must have a supported modem and phone line connected to the unit in order to use this feature. In addition, you must setup **Auto Call Home** within **Blastware** on your PC. Please refer to the **Blastware Operator Manual** for information on how to successfully configure **Auto Call Home** and setup modems for use with the monitor.

To turn **Auto Call Home** on:

1. Use the **Up** or **Down** arrow to highlight the **Auto Call Home** menu item.
2. Press the **Right Arrow** key to enter the editing menu.
3. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **Preferences** menu.
4. The status of **Auto Call Home** can be viewed in the upper right corner of the main menu while monitoring which will indicate **Call Home**, **Connect**, or **Waiting to Retry**.
5. To **Cancel** a call home that is in progress, press the **Cancel** key only once – two key presses will also end the monitoring session.

(1) Selected Modem

Use the **Modem** menu option to select a driver for the specific modem that you have connected to the monitor. A modem script file must be downloaded from **Blastware** if modem communications are required. Connect the **Series IV** monitor to the PC using the communications cable. Within **Blastware**, use the **Blastware Unit** > **Reload Operating System** > **Reload Library Components Only** dialog to download a selected modem driver. Refer to the **Blastware Operator Manual** for more information on downloading a modem script file.

To select a **Modem** on the unit:

1. Use the **Up** or **Down** arrow to highlight the **Modem** menu item.
2. Press the **Right Arrow** key until you have selected the modem of your choice, or to turn **Off** the **Modem** option.
3. Press **Enter** key to **Save** any changes, or the **Cancel** key to return to the **Preferences** menu.

(2) Auto Call Home

To turn **Auto Call Home On** or **Off**:

1. Press the **Right Arrow** key until you have selected **On** or **Off**.

(3) Call Home Session Timeout

Use the **Call Home Session Timeout** to automatically terminate after a defined amount of time (1-999 minutes). The time starts as soon as the PC is successfully connected to the remote unit. If an **Auto Call Home** connection is terminated because of this timeout a "Session timeout" entry is made in the CALLHOME.LOG.

1. Press the **Down Arrow** key to highlight **Call Home Session Timeout**.
2. Press the **Right Arrow** key to enter the editing mode.
3. Press the **Right** and **Left Arrow** keys, as required, to place the cursor under the desired value.
4. Press the **Up** or **Down Arrow** keys to edit each field.
5. Press the **Enter** key to save the new setting.

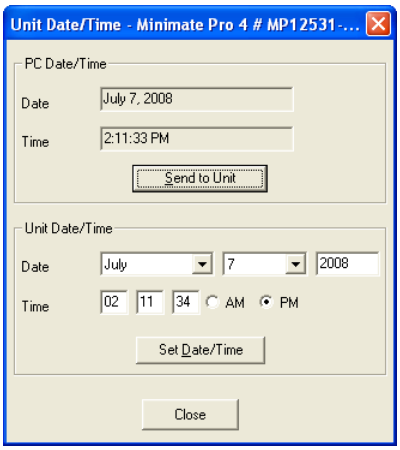
NOTE: Make sure that the timeout is long enough to allow an Event to download before the connection is terminated. For example, a 1- second 4-channel Event recorded at 1024 sps takes about 1 minute to transfer using a typical modem connection.

h. Date and Time:

There are several ways to set the unit **Date and Time**. Either enter the **Date and Time** directly on the unit within the **View/Edit Preferences** menu, or by attaching the unit to the PC and using the **Blastware** program to send a set **Date/Time** or synchronizing with the PCs date and time. The clock on the unit *does not* automatically adjust for Daylight Savings – ensure that you update the clock on these dates so that the correct time is displayed on the **Event Reports**.

Follow the directions below to set the time and date by using the Blastware program:

1. Attach the **Minimate Pro** communications cable between your PC and unit.
2. Start the **Blastware** program; ensure that the baud rate of the **Minimate Pro** and the **Blastware** communications are identical.
3. From the **Unit** menu, select **Date/Time.**
4. Within the **Date/Time** menu, there are two sections, a) **PC Date/Time**, and b) **Unit Date/Time**



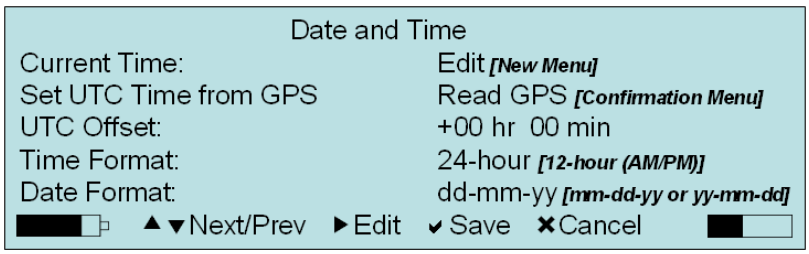
5. Select the **Send to Unit** button to synchronize the unit to the PC **Date/Time**, or
6. **Enter** the **Date/Time** within the fields under the **Unit Date/Time** section, and select the **Set Date/Time** button.
7. Select **Close** to exit the dialog.

Follow the directions below to set the time and date by using unit menu:

Access the **Date and Time** command to set the unit time, using a **12** or **24-hour** format, manually or from an attached GPS device. The time may also be sent from **Blastware** to synchronize with the PC setting. Refer to your **Blastware Operator Manual** for more information about synchronizing the time.

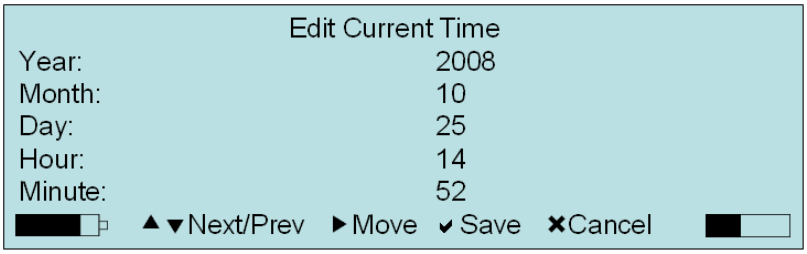
There are three **Date Formats** available: **mm-dd-yy** (Month – Day – Year), **dd-mm-yy** (Day – Month – Year), or **yy-mm-dd** (Year – Month – Day). The date format will appear on all subsequent data, including **Event Reports**.

From the main menu, press the **Setup** key **> View/Edit Preferences > Date and Time**.



(1) **Current Time:**

1. To set the **Current Time**, press the **Setup** key and press the **Down Arrow** key until **View/Edit Preferences** is highlighted.
2. Press the **Enter** key.
3. Press the **Down Arrow** key until **Date and Time** is highlighted, than press the **Right Arrow** key to access the menu.
4. **Current Time** is the first item within the **Date and Time** menu. Press the **Right Arrow** key to access the menu and change the current time manually. The following menu appears:

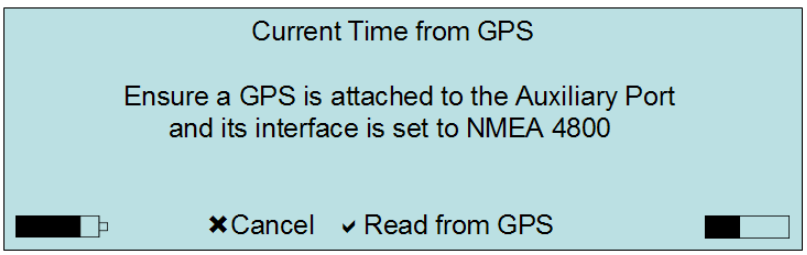


5. Use the **Down Arrow** to highlight the item you want to change, and then press the **Right Arrow** enter the editing mode.
6. Press the **Right** or **Left Arrow** to move to the next value entry.
7. Press the **Up** or **Down Arrow** to change the value of each field.
8. Press the **Enter** key to **Save** the changes, or the **Cancel** key to exit without saving any changes made.

(2) **Set UTC Time from GPS:**

For accuracy and synchronization of several units, the unit time can also be set with a GPS device. This **UTC** (Coordinated Universal Time) time is created from the mean solar time at the Royal Observatory, Greenwich. If you are using a GPS device to set the time, you will also need to set the **UTC Offset**, refer to part **(3)**.

1. To set the time with a GPS device, press the **Down Arrow** key until **Set UTC Time from GPS** is highlighted. Press the **Right Arrow** key to **Read**.
2. A **Current Time from GPS** confirmation menu appears, requesting that you ensure a NMEA 4800 compliant interface is selected:


Current Time from GPS
Ensure a GPS is attached to the Auxiliary Port
and its interface is set to NMEA 4800
✖Cancel ✔Read from GPS

3. Press the **Enter** key to Read from GPS, and the unit responds with a brief message, “Setting Time from GPS. Please Wait…”

4. The **UTC Offset** menu appears and is used to adjust the UTC GPS time zone to your location. If you are unsure of the time zone in relation to UTC, please refer to the link below:

   http://tycho.usno.navy.mil/tzones.html

5. Press the **Right Arrow** key to access the edit value fields.
6. Press the **Up** or **Down Arrow** keys to adjust the + or –, **hr**, and **min**.
7. Press the **Enter** key to **Save**, or the **Cancel** key to return to the previous menu.
8. Press the **Cancel** key to return to the previous menu.

(3) **Time Format:**

1. To set the **Time Format** to either **24-hour** or **12-hour**, press the **Setup** key and press the **Down Arrow** key until **View/Edit Preferences** is highlighted.
2. Press the **Enter** key.
3. Press the **Down Arrow** key until **Date and Time** is highlighted, than press the **Right Arrow** key to access the menu.
4. Press the **Down Arrow** key until **Time Format** is highlighted within the **Date and Time** menu. Press the **Right Arrow** key to edit and toggle between **24-hour** and **12-hour**.
5. Press the **Enter** key to **Save** the new **Time Format**.

(4) **Date Format:**

1. To set the **Date Format** to **yy-mm-dd**, **mm-dd-yy**, or **dd-mm-yy** press the **Setup** key and press the **Down Arrow** key until **View/Edit Preferences** is highlighted.
2. Press the **Enter** key.
3. Press the **Down Arrow** key until **Date and Time** is highlighted, than press the **Right Arrow** key to access the menu.
4. Press the **Down Arrow** key until **Date Format** is highlighted within the **Date and Time** menu. Press the **Right Arrow** key to edit and toggle between **yy-mm-dd**, **mm-dd-yy**, or **dd-mm-yy**.
5. Press the **Enter** key to **Save** the new **Date Format**.

i. Password Protection:

This feature activates a password control requiring an operator to enter a password before being able to exit a monitor mode. The password prevents an unauthorized exit from monitor mode while still allowing an operator to view **Event** summaries. Password control can be turned on or off. The operator doesn't need to know the password to change it or to turn it **On/Off**: However, they do need to know the password to stop a monitoring session if the feature is turned **On**.

(1) Use the **Down Arrow** key to highlight **Password Protection**.

(2) Press the **Right Arrow** key to access this feature.

(3) **Highlight Password Protection** and us the **Right Arrow** to turn it **On**.

(4) Press the **Down Arrow** key to highlight **Enter New Password**.

(5) Press the **Right Arrow** key to edit the password.

(6) Press any sequence of 4 keys to set a password that will prevent an interruption in recording. When the fourth key press is entered, the password is set. Any key may be used with the exception of **On/Off** and **Cancel**.

j. Reset to Factory Defaults:

A default setup file has been provided with the **Minimate Pro** which reverts the setup and preferences to the original configuration at time of shipment. This will not delete setup files or saved information.

(1) From the main display, press the **Setup** key.

(2) Press the **Down Arrow** key until **View/Edit Preferences** is highlighted, and press the **Right Arrow** key to access the menu.

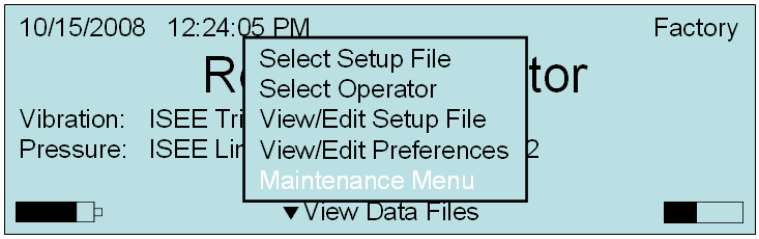
(3) Press the **Down Arrow** key until **Reset Factory Defaults** is highlighted.

(4) Press the **Right Arrow** key to reset the factory defaults **Now.**

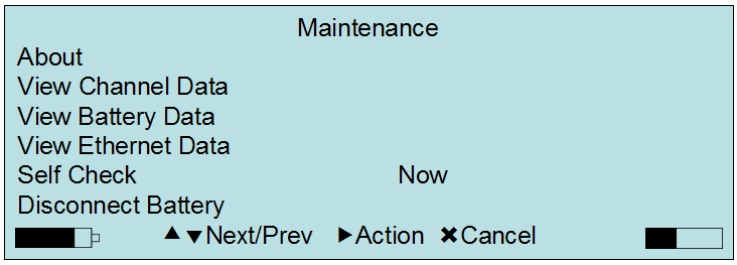
(5) A message appears, "**Unit Set to Factory Defaults**" – press the **Enter** key to **Continue**.

9.6. Maintenance Menu

3. The **Maintenance Menu** provides several options to help **Instantel Technical Services** diagnose any reported errors.
4. Select the **Setup** key on the unit to access the main setup selection menu. Use **Down Arrow** key and highlight the **Maintenance Menu** item. Press the **Enter** key to select **Maintenance Menu**.



5. Press the **Up** or **Down Arrow** keys on the unit to highlight **Next/Prev Setup Maintenance Menu** options. Press the **Right Arrow** key to **Action** a **Maintenance Menu** option. At any time, press the **Cancel** key to return to the previous screen.



a. About

The **About** command opens a new screen that displays the following information:

Model and Serial Number

Firmware Release Number and Date

Calibration Date

Free Memory

Battery Percent

(1) Press the **Right Arrow** key to select the **About** command

(2) Press the **Cancel** key to return to the **Maintenance** menu.

b. View Channel Data

The **View Channel Data** menu is a diagnostic tool that an **Instantel Technical Services Representative** may ask you to describe the information shown.

(1) Press the **Down Arrow** key to scroll and highlight the **View Channel Data** menu option.

(2) Press the **Right Arrow** key to enter the **View Channel Data** display menu.

(3) After a few seconds, the data will appear for Channels 1-3.

(4) If you are using a **Minimate Pro6** unit, you can press the **Enter** key to access the Channel 4-6 data. This includes channel **Value**, **Minimum**, **Maximum**, **Average**, and **Maximum Difference**.

(5) Press the **Cancel** key to exit the previous menu.

c. View Battery Data

The **View Battery Data** menu is a diagnostic tool that an **Instantel Technical Services Representative** may ask you to describe the information shown.

(1) Press the **Down Arrow** key to scroll and highlight the **View Battery Data** menu option.

(2) Press the **Right Arrow** key to enter the **View Battery Data** display menu.

(3) Battery data for **Voltage**, **Percent Charged**, **Temperature**, and **Current** is displayed.

(4) Press the **Cancel** key to exit the previous menu.

d. View Ethernet Data

The **View Ethernet Data** provides information about the **Ethernet** settings, including the **Mac Address**, the status (**Automatic** or **Static**), and the assigned **IP Address**. If the unit is successfully communicating with a network connection, the **Mac Address** and **IP Address** will indicate **Enabled** and **Up**.

(1) Press the **Down Arrow** key to scroll and highlight the **View Ethernet Data** menu option.

(2) Press the **Right Arrow** key to enter the **View Ethernet Data** display menu.

(3) Press the **Cancel** key to exit the previous menu.

e. Self Check

Select the **Self Check** mode for where you require a record indicating the monitor was operating properly. An **Instantel Service Technician** may ask you to perform this **Self Check**. This is a diagnostic tool that displays the status of various hardware and software components. The results of the **Self Check** are displayed on three screens on the unit and any items that are tested that don't pass, are listed in the **Monitor Log** as **Failed**. The

Service Technician can assist you in determining how to repair or describe a workaround for returning the monitor to a working state.

(1) Press the **Down Arrow** key to scroll and highlight the **Self Check** menu option.

(2) Press the **Right Arrow** button to activate **Self Check – Now**.

(3) Press the **Enter** key to **Continue** to each screen until you are returned to the main display. Review each screen to ensure a **Fail** does not appear.

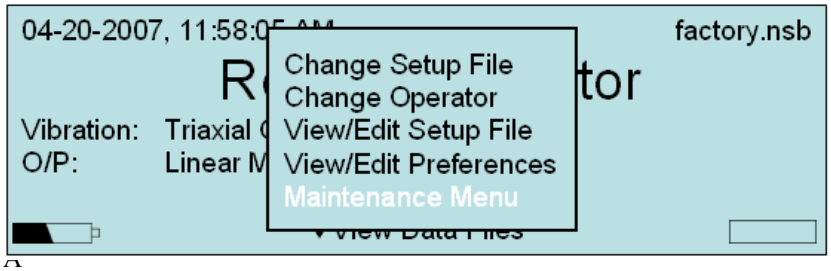
(4) A list of 14 diagnostic results will appear with a **Pass** or **Fail** shown next to them. Only items listed with a Fail result will appear in the unit Monitor Log.

f. Disconnect Battery

Use the **Disconnect Battery** feature if you are planning to store the unit, prepare it for transportation for service or calibration, or if the unit is not performing to standards.

(1) Select the **Setup** key on the unit.

(2) Press the **Down Arrow** to scroll and highlight the **Maintenance Menu**. Press the **Enter** key to accept the selection.

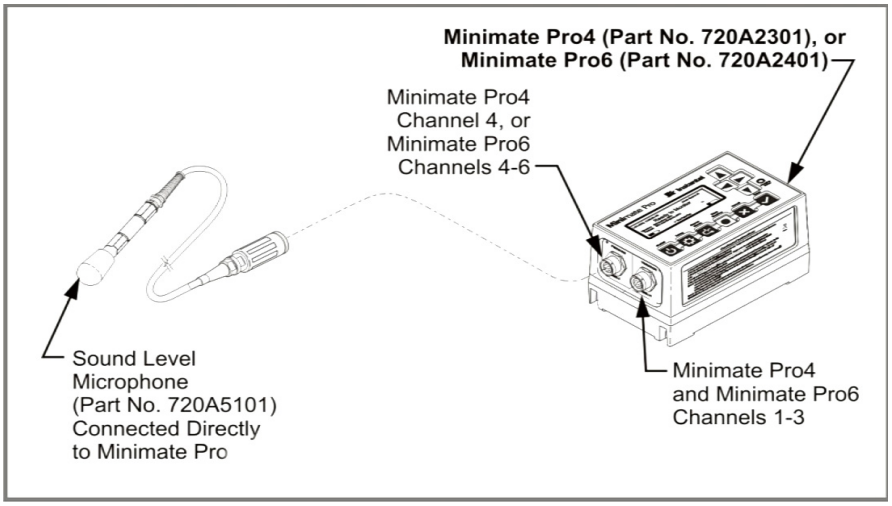


(3) A message will appear, "Disconnecting the battery will shut the unit down. Press the **Right Arrow** key to proceed, or any other key to cancel." Press the **Right Arrow** key and the unit will power off.

g. Sound Level Microphone Field Calibration

It is the operator's responsibility to ensure that the optional Class 1 Sound Microphone (Part No. 720A5101) is calibrated. The following sound microphone calibrators are recommended: B & K Type 4231, Deltaohm HD 9101 or Rion NC-74.

(1) Attach the Sound Level Microphone to the Minimate Pro4 or Minimate Pro6, as shown below:



(2) Select the **Setup** key on the monitor.

(3) Press the **Down Arrow** key to scroll and highlight the **Maintenance Menu**.

(4) Press **Enter**.

(5) Press the **Down Arrow** key to scroll and highlight the **Sound Level Microphone Field Calibration**. Press the **Right Arrow** key to accept the selection.

(6) The **Calibrate Sound Level Microphone** appears. This menu displays the following message, "**The calibration date will be set to:**" and shows the current date.

(7) Press the **Right Arrow** key to select the **Calibrate** command, or press the **Cancel** key to return to the **Maintenance** menu.

(8) If the **Calibrate** command was selected, a new prompt appears, "**Connect Sound Level Microphone to Channel 4 – Connect and turn on calibration reference.**" Follow the field calibration operator manual instructions and attach the field calibration device to the end of the microphone.

(9) Press the **Right Arrow** key to select the **Calibrate** command, or press the **Cancel** key to return to the **Maintenance** menu.

(10) When complete, the monitor displays one of the following messages:

1) If the measured signal is less than 94 dB: **"Error Calibrating Sound Level Microphone. Calibration reference not detected. Existing Calibration retained."**

Press the **Enter** key to continue.

Or,

2) If the measured signal is greater than 94 dB: **"Error Calibrating Sound Level Microphone. Calibration reference signal too large. Existing Calibration retained."**

Press the **Enter** key to continue.

(11) If the monitor and field calibration instrument are unable to calibrate the microphone, the following message appears**, "Error calibrating the Sound Level Microphone. Please send the Microphone to be serviced."**

(12) If the field calibration was successful, the following message appears, **"Calibration successful. Do you wish to save the new calibration results?"**

(13) Press the **Right Arrow** to save the calibration results, or press **Cancel** to retain the original calibration date. If the changes are accepted, the information will appear on the Event Report showing the Company Name of the Calibrator in the **"Field Calibration"** field**.** Refer to the Blastware Operator manual for more information.

NOTES:

10. SENSORS

10.1. Calibration Overview

10.1.1. Why Calibration is Important

Calibration is important to ensure the instrument is performing as it was designed to, and measures accurately the true ground vibration and air overpressure. The recommended interval for calibration of most measuring equipment including seismographs is one year. Across most of North America and many parts of Europe regulatory authorities actually require vibration monitors to be calibrated on an annual basis. This requirement has been or is being adopted by several other countries around the world and some specific projects even require that seismographs be calibrated every three or six months.

10.1.2. What the Calibration Certificate Means

Should an authority question your vibration records, a Calibration Certificate is the document that provides proof of professional calibration. When your vibration monitor is calibrated at **Instantel**, a Calibration Certificate is issued. To ensure the validity of each calibration, the reference equipment used is also calibrated and is traceable to a nationally recognized standard, such as the National Institute of Standards and Technology (NIST) in the United States, or the National Research Council (NRC), in Canada. The calibration certificate also contains the model, serial number, and date the instrument was calibrated, and who performed the calibration.

10.1.3. Importance of Manufacturer Certified Calibration

Using a manufacturer certified facility ensures that proper procedures are followed when calibrating your vibration monitor. This removes any uncertainty associated with the reliability and measurement accuracy of your monitor, and ensures the integrity of the measured record if it is ever called up as evidence in a court of law. There are individuals and companies worldwide that are not certified by the manufacturer to perform vibration monitor calibration, yet continue to do so. It is in your best interest to have your monitor calibrated by the specific manufacturer or their authorized agents. Using unauthorized facilities may cause problems in court if the reference equipment is not traceable, or if the certification documents are incomplete.

10.1.4. Minimate Pro Sensor Check Feature

The only purpose of the **Sensor Check** feature on **Instantel** vibration monitors, is to ensure that the sensors have been connected and installed correctly. If a sensor was not level, or was upside down, the monitor would indicate a failed **Sensor Check**. The **Sensor Check** is NOT a calibration check and cannot replace the annual calibration process. **Sensor Check** does not compare the measured result against an external traceable reference sensor, nor does it test the entire electronic circuit that is integral to the sensors response.

10.2. References to Minimate Pro4 and Minimate Pro6

The **Minimate Pro6** monitor offers additional flexibility for compliance monitoring. On the **Minimate Pro6**, a second Geophone may be connected to the channel labeled **PRESSURE**, instead of a Microphone. On the **Minimate Pro4**monitor, this channel is labeled **PRESSURE** and is solely used for overpressure monitoring using the Linear Microphone. These channels are also labeled within the display and **View/Edit** setup file, dependent on which instrument you have purchased.

10.3. Series IV Sensor Specifications

SPECIFICATION	SERIES IV SENSOR		
	DIN Geophone	ISEE Geophone	ISEE Linear Microphone
Part Number	720A2002 (315 Hz), or 720A2003 (80 Hz)	720A2001	720A1801
Frequency Weighting	N/A	N/A	Linear
Response Standard	DIN 45669-1 Class 1	ISEE Seismograph Specification	ISEE Seismograph Specification
Operating Frequency Range	1 to 315 Hz (718A3301), or 1 to 80 Hz (720A2003 for **VDV Record Mode**)	2 to 250 Hz	2 to 250 Hz
Sound Range	Up to 254 mm/s (10 in/s)	Up to 254 mm/s (10 in/s)	88 to 148 dB
Resolution	0.0159 mm/s (0.000625 in/s)	0.0159 mm/s (0.000625 in/s)	0.25 Pa (0.0000363 psi), .1 dB
Sensor Density	2.13 g/cc (133 lbs/ft^3)	2.13 g/cc (133 lbs/ft^3)	N/A
Standard Cable Length	1.8 m (6 ft)	1.8 m (6 ft)	1.8 m (6 ft)
Maximum Cable Length	1000 m (1094 yards)	75 m (250 ft)	75 m (250 ft)
Weight	2 lb (.9 kg)	2 lb (.9 kg)	1 lb (.25 kg)

10.4. Installing an ISEE or DIN Geophone

The following sections apply to the **Minimate Pro** with a **Series IV** ISEE or DIN Geophone, as supplied by **Instantel**. To help differentiate between the two geophone types, the DIN Geophone has a blue lid, whereas the ISEE Geophone has a silver lid.

The sections illustrate installation procedures recommended by **Instantel**. Your particular monitoring activities may employ one or a combination of all of the following procedures. You may even devise your own method for a specific application. It is important for you to securely attach the Geophone to the **Minimate Pro** to ensure reliable monitoring results.

The following sections provide example installation methods. For wall and ceiling installations, refer to the Reference chapter.

1. Arrow Pointed in Direction of the Event

The arrow on top of the Geophone must be pointed in the direction of the Event to ensure the geophone sensors, located inside, remain in their natural axis.

2. Level Installation

The Geophone must be level when installed. A leveling plate is available to install the Geophone. Both the fastening plate and the leveling plate have three leveling feet and an integrated bubble level indicator.

3. Securely Coupled to the Surrounding Surface

The Geophone must be securely attached to the ground with the provided spikes, or buried. The surface must be compact with no loose or soft material close to the Geophone. Secure attachment is critical for reliable and accurate monitoring results. Insufficiently secured, and the Geophone will move independently of the surrounding surface resulting in distorted, often higher, monitoring results.

Installation methods depend upon the type of surface. It is up to you to check the surface and mount the Geophone sufficiently to ensure reliable monitoring results.

10.4.1. Soft Surface Installations

Always install and use the ground spikes provided with the Geophone. For the best installation, it is suggested to bury the Geophone, or for very low level velocities, place a sandbag on top of it.

a. Burying and using the Ground Spikes with the Geophone

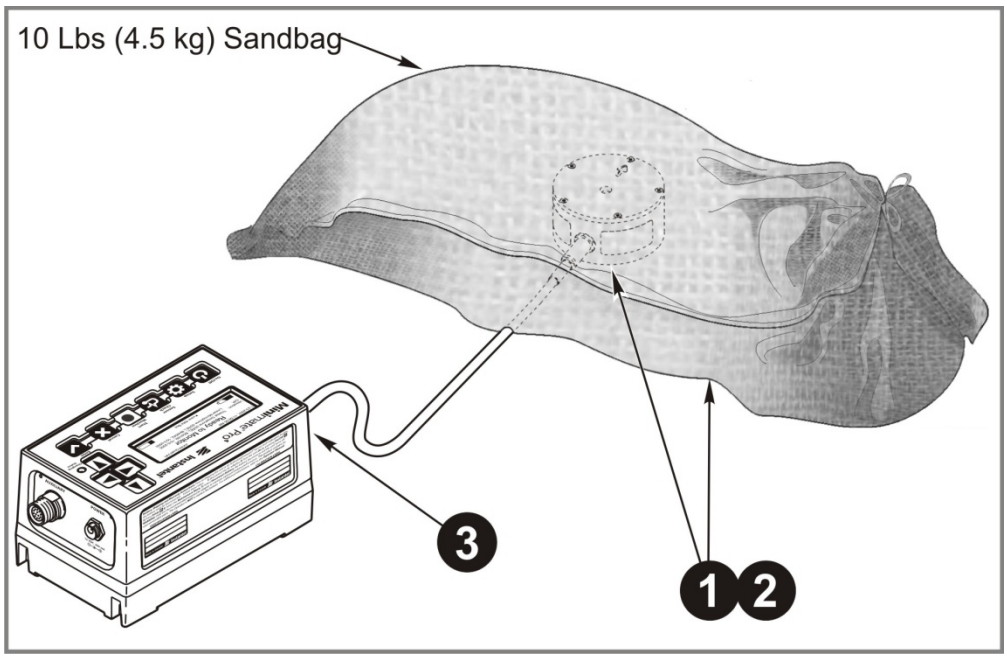
1. Screw the three ground spikes into the bottom of the Geophone and tighten.

   NOTE: Do not over-tighten the ground spikes as this can damage the casing of the Geophone.

2. Dig a hole from four inches (10 cm) to six inches (15 cm) deep.
3. Aim the arrow on the top of the Geophone in the direction of the Event.
4. Firmly press on top of the Geophone to push the spikes fully into the ground. Check the Geophone to ensure it is securely in place and level.
5. The ground must be hard and compact with no loose material between the Geophone and the compact ground material.
6. Compact the material around the Geophone while back filling to secure it to the surrounding ground material.
7. Ensure that the Geophone is securely attached to the **Vibration** port on the **Minimate Pro**.
8. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

b. Sandbagging the Geophone –Very Low Velocity Levels Only

Use this method of installation for monitoring where velocity levels remain very low.



Refer to the illustration above and follow the installation instructions below:

1. The sandbag must be of sufficient size to cover the entire Geophone and the surrounding surface.
2. The sandbag should weigh at least 25 pounds (12 kg) and contain sand or 1/4" washed gravel.
3. Ensure that the Geophone is securely attached to the **Vibration** port on the **Minimate Pro**.
4. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

10.4.2. Hard Surface Installations

For hard surface installations, such as rock, concrete or solid ice, the preferred installation method bolts the Geophone directly to the surface.

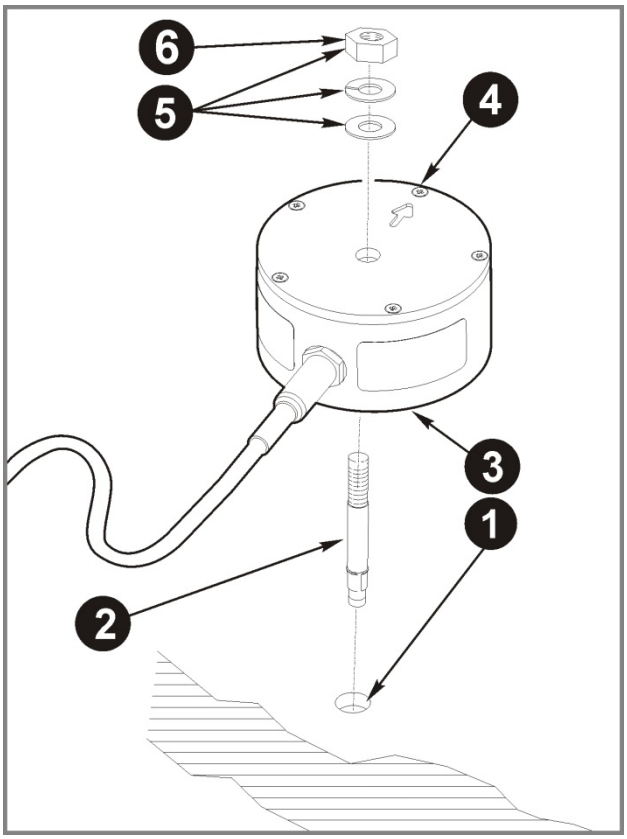
a. Bolting the Geophone Directly to a Surface

A Series Geophone may be bolted directly to a surface using the provided thru-hole, with the aid of the optional leveling plate, or the Geophone Wall Mount Kit.

(1) Geophone Direct Hard Surface Mount Installation Instruction

Tools and Materials Required:

3. Hammer
4. Drill bit and drill for bolt or threaded rod
5. 3/8 inch (9.5 mm) wrench
6. 3/8 inch (9.5 mm) bolt or threaded rod
7. 3/8 inch (9.5 mm) retaining washer, lock washer, and nut



Refer to the illustration above and follow the installation instructions below:

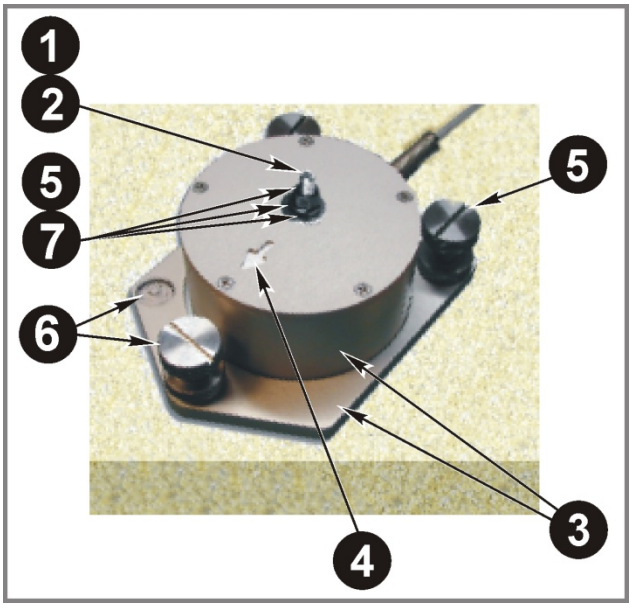
NOTE: If the Geophone is being mounted to the ceiling, the directional arrow must be mounted against the ceilings surface to ensure that the orientation of the internal vertical transducer is correctly positioned. If it is not correctly positioned, the **Sensor Check** feature of the unit will indicate that the position of the Geophone needs to be checked.

1. Position the Geophone on the surface and mark the position of the bolt hole, which is located at the center of the Geophone.
2. Use a 3/8 inch (9.5 mm) bolt or threaded rod. Install the bolt into the hard surface according to the manufacturer's instructions.
3. Slide the Geophone over the bolt.
4. Ensure that the arrow on the Geophone is pointing in the direction of the Event.
5. Place a 3/8 inch (9.5 mm) retaining washer, lock washer, and nut over the bolt.
6. Carefully tighten the retaining nut to complete the installation.
7. Ensure that the Geophone is securely attached to the **Vibration** port on the **Minimate Pro**.
8. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

(2) Geophone Leveling Plate Installation Instruction

Tools and Materials Required:

1. Triaxial Geophone Leveling Plate Kit (Part No. 714A1801)
2. Hammer, drill bit and drill for bolt or threaded rod
3. 3/8 inch (9.5 mm) wrench
4. 3/8 inch (9.5 mm) bolt or threaded rod
5. 3/8 inch (9.5 mm) retaining washer, lock washer, and nut



Refer to the illustration above and follow the installation instructions below:

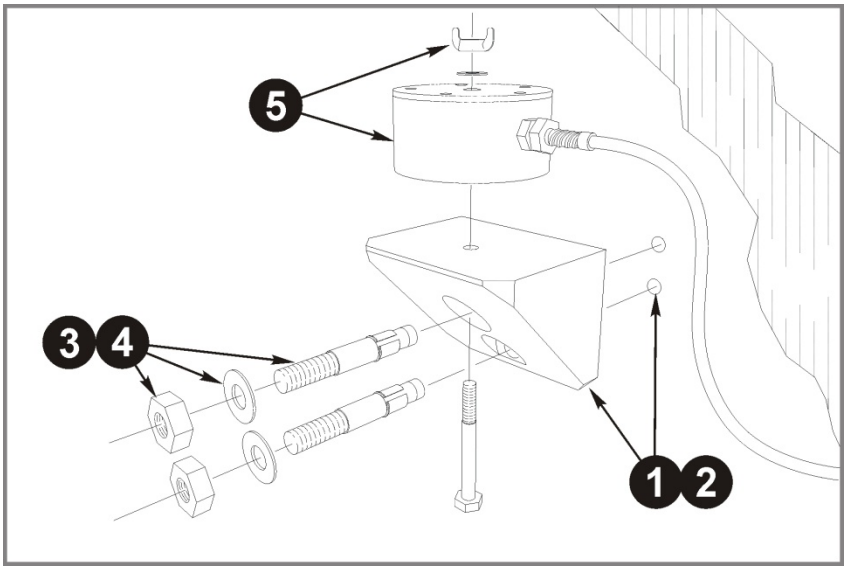
1. Position the Geophone with leveling plate on the surface and mark the position of the bolt hole, which is located at the center of the Geophone.
2. Use a 3/8 inch (9.5 mm) bolt or threaded rod. Install the bolt into the hard surface according to the manufacturer's instructions.
3. Slide the Geophone and leveling plate over the bolt.
4. Ensure that the arrow on the Geophone is pointing in the direction of the Event.
5. Place a 3/8 inch (9.5 mm) retaining washer, lock washer, and nut over the bolt but do not tighten.
6. Level the Geophone using the leveling feet and integrated bubble level.
7. Carefully tighten the retaining nut to complete the installation.
8. Ensure that the Geophone is securely attached to the **Vibration** port on the **Minimate Pro**.
9. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

(3) Geophone Wall Mount Kit Installation Instruction

Tools and Materials Required:

1. Geophone Wall Mount Kit (Part No. 718A0101)
2. Hammer
3. 19mm (3/4 inch) deep-throated socket and ratchet
4. 13mm (1/2 inch) wrench
5. 12mm (.47 inch) drill bit and drill

NOTE: To install the Geophone Wall Mount, dependent on your application, you may need to acquire alternative mounting hardware than what has been provided with the kit.



Refer to the illustration above and follow the installation instructions below:

1. Using the Geophone Wall Mount as a template, orient the block as shown, and mark the location of the two holes to be drilled.
2. Remove the Geophone Wall Mount, and drill two 12mm (.47 inch) diameter holes; drill the holes to a depth of 89mm (3.50 inches).
3. Place a nut on the end of each wedge anchor bolt to protect the threads, and using a hammer, securely drive each bolt into place. Ensure that at least 32mm (1.25 inches) of each of the wedge anchor bolt threads extend from the wall.
4. Remove the nuts from the wedge anchor bolts, and reposition the Geophone Wall Mount. Secure it using two washers, the two nuts previously removed, and a deep-throat socket with a ratchet.
5. Position the Geophone (not included in the kit) on top of the Geophone Wall Mount, aligning the through-hole of the geophone with the mount; secure it using the bolt, washer, and wing nut. Ensure that the arrow on the ISEE Geophone is pointing in the direction of the Event. Hand-tighten the wing nut – DO NOT use a wrench or pliers to tighten the wing nut, as this may damage the Geophone.
6. Ensure that the Geophone is securely attached to the **Vibration** port on the **Minimate Pro**.
7. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

10.4.3. Geophone Theory of Operation

This section describes how **Instantel's** Geophones operate. A Geophone measures ground vibrations. The actual mechanism inside the Geophone is called a transducer. Geophones have either one transducer, called Uniaxial Geophone, or three transducers, called Triaxial Geophones.

a. Geophone Operation

Functionally, a geophone sensor is a coil of wire suspended around a magnet. The magnet is free to move in a field of magnetic flux lines. By Lenzs' Law, induced voltage is proportional to the speed at which flux lines are traversed. Induced coil voltage is therefore proportional to the relative velocity of the coil to the magnet. In practice, it does not matter whether the coil or the magnet moves. Only the motion and speed relative to each other are important.

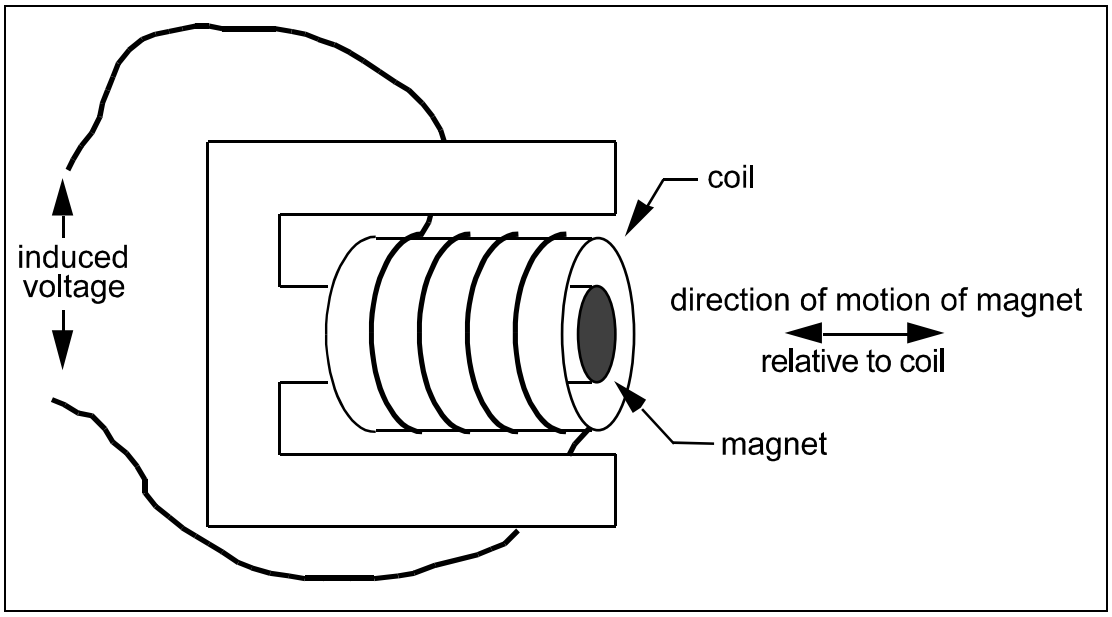


Figure 10.1 Geophone Sensor Operation.

Geophone sensor specifications give a number known as the Intrinsic Voltage Sensitivity. It is the coil voltage induced for a given coil versus magnet speed with units of V/in/s. In seismic applications, the magnet is moved by the blast energy because it is coupled to the particles of the surrounding terrain. The coil, because of its inertia, does not move and the resulting magnet versus coil motion induces a voltage which is proportional to particle velocity.

b. Geophone Calibration Requirements

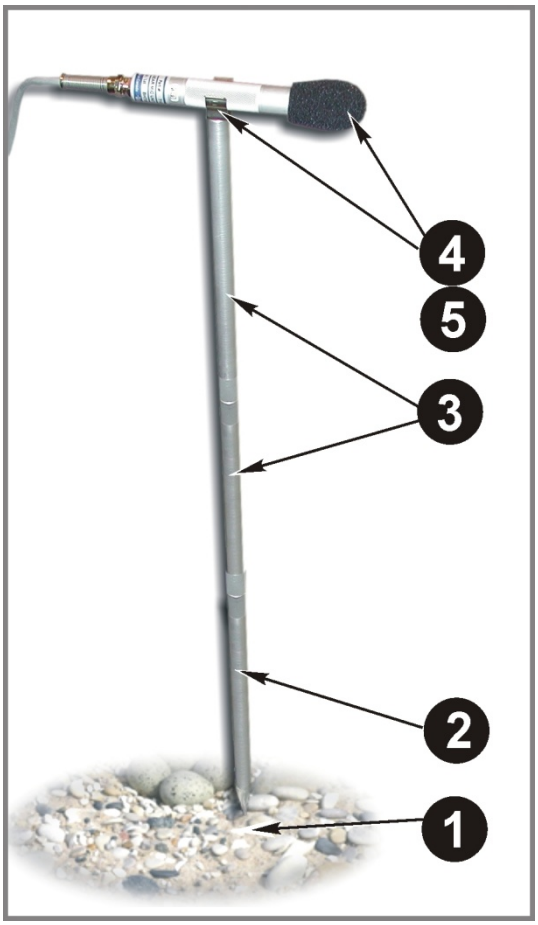
Instantel's Geophone must be calibrated annually by **Instantel** or an **Authorized Instantel Service Facility**. Contact your dealer for further information.

10.5. Installing the ISEE Microphone

(1) Microphone Installation Procedure

Tools and Materials Required:

1. Rubber Mallet, as required



Refer to the illustration above and follow the installation instructions below:

Instantel Series IV Microphones come with a sectional three foot (one meter) mounting stand.

1. Locate the position of interest where you will be inserting the mounting stand.
2. If required, use a rubber mallet to insert the lower part of the sectional mounting stand into the ground.
3. Assemble the remainder of the mounting stand by adding, as required, the two threaded sectional pieces.
4. Insert the microphone into the mounting bracket on the top of the stand, and attach the windscreen to reduce false triggering caused by wind.
5. Point the microphone in the direction of the Event.
6. Ensure that the Microphone is securely attached to the **Vibration** port on the **Minimate Pro**.
7. Press the **Sensor Check** key on the **Minimate Pro** to ensure that the sensor is properly attached.

NOTE: The microphone windscreen attenuates the microphone reading by 0.2 dB. In most cases, this does not have a material impact on results.

WARNING: Handle the microphone with care. Dropping the microphone or otherwise subjecting it to impact may damage the microphone element. The windscreen can help to protect the microphone, and its use is recommended.

10.5.2. Microphone Theory of Operation

This section describes how the ISEE Linear Microphone operates. The ISEE Linear Microphone measures air pressure.

a. Measurement Scales

The **Minimate Pro** supports the Linear "L" sound pressure measurement scale.

(1) Linear "L"

Linear measurement is generally used to measure the effect of low frequency air pressure on buildings. The linear scale records sound pressure without modification in the 2 to 300 Hz range. Measurement units may be in absolute, Pascal, or relative dB scales.

b. Microphone Calibration Requirements

Instantel's ISEE Linear Microphone must be calibrated annually by **Instantel** or an authorized **Instantel** service facility. Contact your dealer for further information.

11. OPERATOR MAINTENANCE

11.1. Operator Maintenance

Several levels of maintenance are available for the **Minimate Pro** with each level being dependent on the type of repair required. Any maintenance not outlined below must be performed by your **Instantel Dealer Representative** or Calibration Site, or the **Instantel** Service Department. Any maintenance performed on the unit that is not included in the list below will void the warranty as specified at the beginning of this manual. Refer to Chapter 3, Handling Precautions prior to performing any maintenance procedures.

The following outlines the maintenance procedures that may be performed by the Operator:

- **Storage**
  When storing the instrument, ensure that you charge the battery for at least 24 hours and then use the **Disconnect Battery** command within the **Maintenance Menu**.
- **Replace Power Adapter**
  If required, replacement power adapters are available from your **Instantel Dealer Representative** or directly from **Instantel**.
- **Reload Operating System**
  To complete a field repair, a new version of the unit operating system must be downloaded to the **Minimate Pro**. If a new version of software is provided, refer to the **Blastware** Operator Manual and follow the instructions for **Reloading the Operating System**.
- **Periodic Cleaning**
  Use compressed air to remove loose dirt and surface dust. Vacuum dust, dirt, and sand from the **Minimate Pro** monitor keypad area. Use alcohol to remove stains. **DO NOT** use paint thinners and ketone solvents. These will damage the **Minimate Pro**. To avoid scratching the protective cover and display, do not scrub the surfaces with abrasive cleaning materials including cleaning pads.
- **Replace Dust Caps**
  If required, replacement dust caps for the connectors on the unit are available from **Instantel**. Replacement dust caps located on the sensor cables must be replaced at an authorized repair facility or at **Instantel**.
- **Maintenance as directed by an Instantel Service Technician**
  Occasionally, an **Instantel** Service Technician may authorize an in-field repair by the Operator. Typically, an instruction sheet is provided and the technician guides the Operator through the procedure.

NOTES:

12. TECHNICAL REFERENCE

12.1. Anti-alias Filters

Aliasing occurs when a high–frequency signal appears as an erroneous low frequency because the waveform was sampled at too low a sampling rate. An anti-aliasing filter solves this problem by removing the high–frequencies.

12.2. Data Analysis Techniques

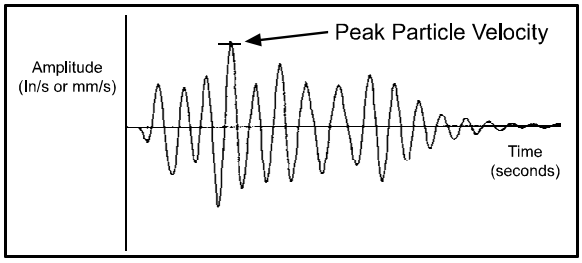
The following sections define the **Minimate Pro** data analysis techniques. The first section, ground vibrations, discusses calculations applied to Event data recorded by a Geophone. The second section, sound pressure, describes the Linear Microphone Event data calculations.

12.2.1. Ground Vibrations

The **Minimate Pro** calculates the Peak Particle Velocity, Zero Crossing Frequency, Peak Acceleration, and Peak Displacement for each of the, transverse, vertical, and longitudinal axis. The **Minimate Pro** calculates Peak Vector Sum using data from all three axis.

a. Peak Particle Velocity (PPV)

Peak Particle Velocity indicates the maximum speed particles travel resulting from an Event's ground vibrations. The **Minimate Pro** calculates the PPV for each Geophone.



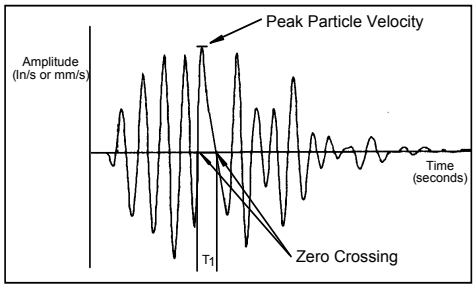
Calculating Peak Particle Velocity

b. Zero Crossing Frequency (ZC Freq)

The Zero Crossing Frequency calculates the Event waveform's frequency at the largest peak.

(1) Calculating Zero Crossing Frequency

To calculate the Zero Crossing Frequency, we need to determine the period of oscillation of the waveform. Convenient waveform positions for measuring period, the time for one complete cycle, occur between two successive peaks, troughs, or zero crossings. The **Minimate Pro** measures between zero crossings. Frequency is the number of periods that occur in one second calculated by the formula: Frequency = 1/period.



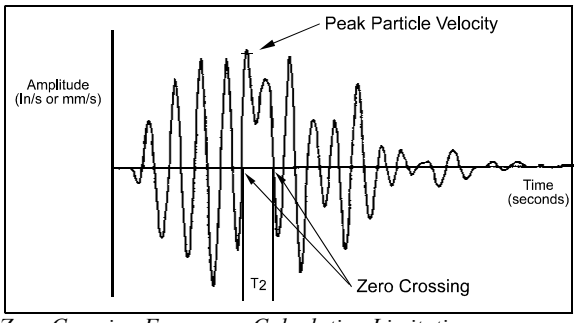
Calculating the Zero Crossing Frequency

(2) Zero Crossing Frequency Limitation

The Zero Crossing Frequency calculation is limited because it assumes a single predominant frequency at the peak, typically represented by sinusoidal waveforms. In practice, the peak may be

the result of two or more major frequency components representing compound waveforms as illustrated in the figure below. It is therefore only an approximation of the frequency of the Peak Particle Velocity.

Waveforms may have the same Peak Particle Velocities but different Zero Crossing Frequencies depending on the shape of the waveforms involved. With reference to the figures above and below; both waveforms have the same Peak Particle Velocities however their Zero Crossing Frequencies differ. In the figure above, the zero crossing frequency uses the 1/2 period indicated by T_1. In the figure below, the zero crossing frequency uses the 1/2 period indicated by T_2. Notice that T_1 is less than T_2 because of the different waveform shapes, therefore the Zero Crossing Frequency in figure above is greater than the Zero Crossing Frequency in the figure below. It is for this reason, the Zero Crossing Frequency may differ for peaks having the same Peak Particle Velocity.



Zero Crossing Frequency Calculation Limitation

(3) Sample Rate Error

The Zero Crossing Frequency requires the period of a wavelength before it can calculate the wavelength's frequency using the formula 1/period. A sampling error occurs for higher frequencies when wavelength periods become relatively small and the sampling rate begins to miss zero crossing points. In other words, the wavelength periods occur much faster than a **Minimate Pro** can sample and use in the calculation.

At higher frequencies there are fewer sample points per cycle and therefore greater error. The following table illustrates how error increases with frequency.

Zero Crossing Frequency Sample Error Rate

Frequency Range	Recording Rate		
	Standard (1024 Hz)	Fast (2048 Hz)	Faster (4096 Hz)
0 – 30 Hz	negligible error	negligible error	negligible error
31 – 50 Hz	up to 5 Hz error	up to 2.5 Hz error	negligible error
51 – 70 Hz	up to 8 Hz error	up to 4 Hz error	up to 2 Hz error
71 – 90 Hz	up to 18 Hz error	up to 9 Hz error	up to 4.5 Hz error
91 – 150 Hz	up to 50 Hz error	up to 25 Hz error	up to 12.5 Hz error

The **Minimate Pro** does not calculate frequencies above 100 Hz because of the high error level at 1024 samples per second. The message ">100 Hz" displays. Furthermore if a waveform is very

complex, or if it contains a large offset value, the zero crossings may lie outside an acceptable window. Whenever a frequency cannot be calculated the message "<1 Hz" displays. The message N/A indicates an entire waveform was not captured and therefore no frequency could be calculated. More accurate analysis is available using the **Blastware** software.

c. Peak Acceleration

The **Minimate Pro** calculates peak acceleration, the rate of change of velocity, by dividing the difference in velocity by the difference in time. To obtain the peak acceleration, the **Minimate Pro** subtracts two velocity readings and divides the result by the elapsed time between them.

$$a = \frac{dV}{dT} \approx \frac{\Delta V}{\Delta T}$$

where:

ΔT = a small interval

The **Minimate Pro** calculates the peak acceleration at each point along the entire waveform and reports the peak value. Note that this is not necessarily at the peak velocity for an individual waveform.

d. Peak Displacement

The **Minimate Pro** calculates peak displacement, or particle distance traveled, by multiplying speed by time. In the **Minimate Pro** the interval velocity is multiplied by the time interval and the resulting displacement segments are summed.

$$s = \int V dt \approx \sum (V \Delta t)$$

where:

V= the velocity in each interval

To obtain the peak displacement, the **Minimate Pro** integrates each wave segment of the entire waveform between zero crossings, selects the largest, then divides the value by half. Note that this is not necessarily at the peak velocity of the waveform.

e. Peak Vector Sum (PVS)

The figure below displays three Event waveforms. The figure illustrates the procedure of graphically calculating peak vector sums. Measured magnitudes are tabulated for six different times and represent velocities in each of the three axes. The vector sum represents the resultant particle velocity magnitude and is calculated by squaring and adding the magnitudes and taking the square root.

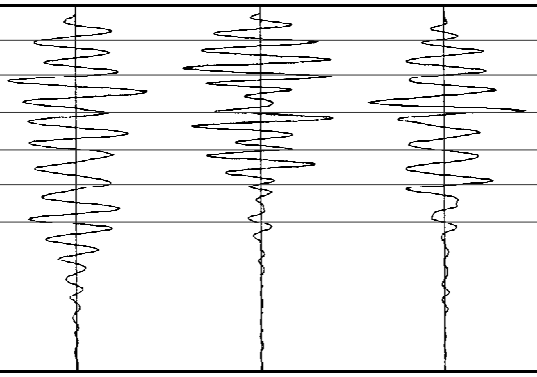
$$PVS = \sqrt{T^2 + V^2 + L^2}$$

where:

T = particle velocity along the transverse plane

V = particle velocity along the vertical plane

L = particle velocity along the longitudinal plane

EVENT WAVEFORMS			MAGNITUDE			PEAK VECTOR
TRANSVERSE	VERTICAL	LONGITUDINAL	T	V	L	
			-0.34	-0.33	0.14	0.494
			0.38	-0.47	0.38	0.714
			0.29	-0.31	0.51	0.663
			-0.53	0.23	-0.31	0.655
			0.24	0.07	0.36	0.440
			-0.23	-0.16	-0.15	0.318

Calculating the Peak Vector Sum

The **Minimate Pro** calculates the peak vector sum for each point of the sampled waveforms and displays the largest value. Note that this is not necessarily at the peak velocity for an individual waveform.

12.2.2. Sound Pressure

The **Minimate Pro** calculates two sound pressure indicators, peak sound pressure and zero crossing frequency.

a. Peak Sound Pressure (PSP)

The **Minimate Pro** checks the entire Event waveform and displays the largest sound pressure called the Peak Sound Pressure (PSP), also referred to as the Peak Air Over–Pressure. Results appear on the **Minimate Pro** display.

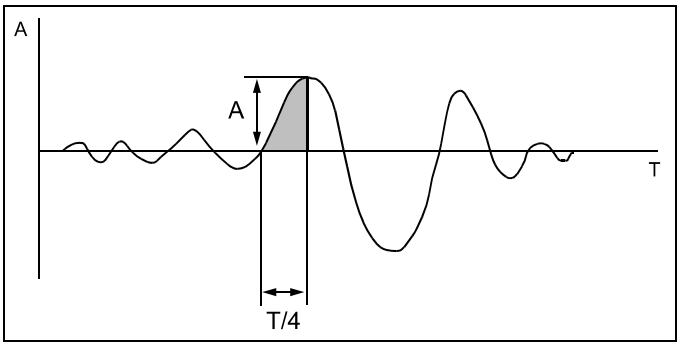
b. Zero Crossing Frequency (ZC Freq)

The Zero Crossing Frequency calculation for sound pressure is the same calculation used for ground vibrations. Please see above for a complete discussion.

Note: The Zero Crossing Frequency calculation is performed for ISEE Linear "L" Microphones.

12.2.3. Sinusoidal Waveforms

The motion is essentially sinusoidal with gradual amplitude and frequency changes.



Manual Waveform Calculations on Sinusoidal Waveforms

a. Calculating Displacement:

Maximum Displacement (in.) $= \frac{T}{2\pi} \times A$

Maximum Displacement (mm) $= \frac{T}{2\pi} \times A_m$

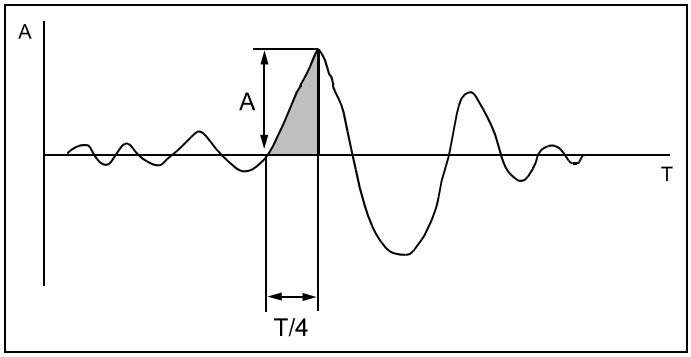
b. Calculating Acceleration:

Maximum Acceleration (in./s^2) $= \frac{2\pi}{T} \times A$

Maximum Acceleration (mm/s^2) $= \frac{2\pi}{T} \times A_m$

12.2.4. Nearly Triangular Waveforms

Motion is irregular and has large amplitude.



Manual Waveform Calculations on Nearly Triangular Waveforms

a. Calculating Displacement:

Maximum Displacement (in.) $= \frac{T}{8} \times A$

Maximum Displacement (mm) $= \frac{T}{8} \times A_m$

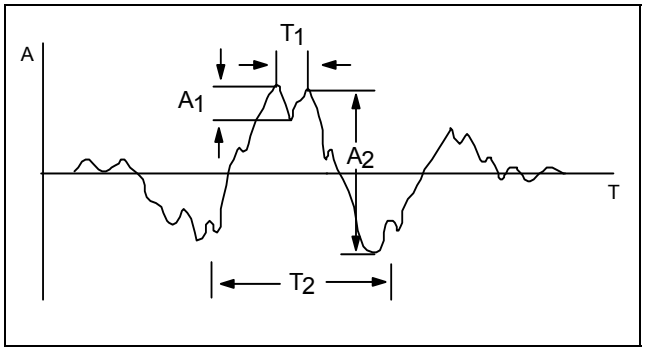
b. Calculating Acceleration:

Maximum Acceleration (in./s^2) $= \frac{1}{T} \times Y$

Maximum Acceleration (mm/s^2) $= \frac{1}{T} \times Y_m$

12.2.5. Compound Waveforms

If the record exhibits interference by two or more predominant frequencies then the maximum displacement will be the sum of the maximum of each individual frequency component.



a. Calculating Displacement:

$$\text{Maximum Displacement (in.)} = \frac{T_1}{2\pi} \times A_1 + \frac{T_2}{2\pi} \times A_2$$

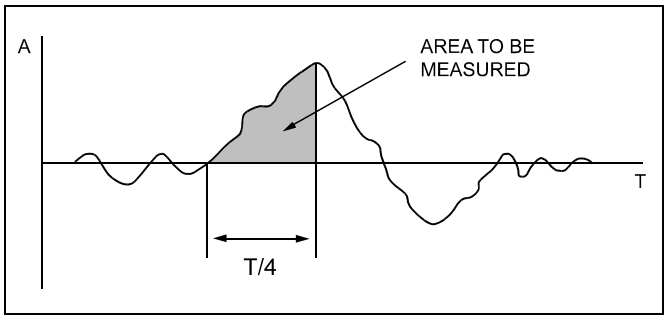
$$\text{Maximum Displacement (mm)} = \frac{T_1}{2\pi} \times A_{1m} + \frac{T_2}{2\pi} \times A_{2m}$$

b. Calculating Acceleration:

$$\text{Maximum Acceleration (in./s}^2\text{)} = \frac{2\pi}{T_1} \times A_1 + \frac{2\pi}{T_2} \times A_2$$

$$\text{Maximum Acceleration (mm/s}^2\text{)} = \frac{2\pi}{T_1} \times A_{1m} + \frac{2\pi}{T_2} \times A_{2m}$$

12.2.6. Irregular Waveforms



Manual Waveform Calculations on Irregular Waveforms

a. Calculating Displacement:

Maximum Displacement = area under curve measured by a planimeter.

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